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NAVAL CONTROL OF WIRELESS.

Should the report just filed of a board appointed by the President to investigate the subject of coastwise wireless telegraphy receive his approval, the Navy will have control of all the wireless systems along the coast of the United States, in the island and other possessions, and on the Panama Canal zone. We have already alluded to the conflict or struggle over this matter between various services of the Government, and are glad to note that a way out is now found. The Navy is to get down to business as soon as possible, and apparently to receive and transmit free all messages from ships, provided there is no interference with commercial stations. With paternal oversight it is recommended that private enterprise and invention should be encouraged in every legitimate way, and "for their mutual as well as public welfare" private stations should be licensed under the supervision of the Department of Commerce and Labor, "to prevent the exploitations of speculative schemes based on a public misconception of the art" and to prevent control by monopolies and trusts.

It will now be very interesting to see how the plan works out. A bad tangle threatened, and if these measures prevent it or even help to keep things straight a great deal will have been gained. The Navy alone is said to have some twenty land stations, thirty-four ships equipped, and sixty-eight more ships to be installed with apparatus, making with thirty new land stations, not less than 152 plants. Possibilities of trouble and interference loom up, however, and so far the Navy has, unfortunately, done nothing very notable or creditable with any of its apparatus. Perhaps it has kept its best results quiet. Anyhow, with a competent board and good methods, we ought now to see improvements and a general gain to the services and the public. Meantime we watch with equal hopefulness such plants as the General Electric Company proposes to operate between its Schenectady and Lynn factories. Such industrial work and facilities seem to have a great future.

THE RECIPROCAL OF CAPACITY.

On page 248 of this number appears an article by Dr. James E. Ives in which the term *rigidance* is proposed for the reciprocal of the capacity of a condenser. It has long been recognized that a condenser behaved under an impressed e.m.f. like an elastic body under an impressed mechanical force; that is to say, it suffered a displacement of an electrical character within its dielectric, similar to the mechanical displacement of the stressed body. The larger the capacity of the condenser, the greater its flexibility from the standpoint of mechanical analogy. A condenser of small capacity corresponds similarly to a relatively stiff or rigid mechanical system. By an extension of the same analogy, the specific inductive capacity of a substance corresponds to the inelasticity, or the inverse of rigidity in mechanics; while the reciprocal of the specific inductive capacity would correspond to rigidity. Heaviside, recognizing these analogies, introduced the term *elastance* for the reciprocal of capacity in 1885, and the term *elastivity* for the reciprocal of specific inductive capacity in 1886 or 1887. Both of these terms have come into limited use among writers on physics. The subject is one in which interest is virtually limited to physicists at present, and consequently the terminology would not be expected to become widespread as yet among the electrical community at large.

Dr. Ives, in the article above referred to, compares the fundamental equations of electrical motion in a condenser, and of mechan-

ical motion in a flexible system, and shows that they are identical in form, if the reciprocal of the capacity is used in the electric case. He alludes to Heaviside's suggestion, but prefers the term *rigidance* to *elastance*, as being more appropriate and self-explanatory, popular concepts concerning elasticity being notoriously elastic, and remote from the technical definitions. This part of the question is, therefore, narrowed to a choice of terms, or a matter of terminology. There can be no doubt, however, that the order of ideas associated with the mechanical analogy, under either set of terms, would be of general technological value. It is impossible to regard the phenomenon of charging a condenser as identical with that of deflecting a flexible mechanical system. The two processes are at best merely similar; but the similarity is of educational value, because from the clearly visible and feelible mechanical phenomenon we can readily apprehend, by the analogy, the invisible electrical process.

In view of the trend of modern electric power transmission, the whole theory of condensers and condenser action calls for extension and vivification. Prior to the nineteenth century electrical knowledge was practically restricted to high-tension electricity, to the electricity of the kilovolt and milliampere. In this direction the voltaic discoveries of the early nineteenth century called a halt, and the armies of research were deployed against low-tension phenomena, the electricity of the ampere and the volt. Now, in the early twentieth century, the work of electric power transmission ascends into the conditions of many kilovolts once more, and all the old order of ideas in high tension have to be reorganized for practical use, with the assistance gained from the study of low-tension phenomena. It is natural that this reorganization and extension should involve new definitions, formulas and associations of ideas. The voltaic circuit has had attention now for many years. The electrostatic circuit, or what corresponds thereto, now claims recognition. For this reason also Dr. Ives' suggestions should receive attention.

RECTIFICATION OF ALTERNATING CURRENTS IN GASES.

When we watch a large, alternating-current power station at work with its alternators delivering energy to the system, the energy subsequently to be employed for operating direct-current motors, or charging storage batteries, it always seems forced and unnatural to require rotating mechanism between the generators and translating devices of the system in the form of converters or motor-generators, merely to change the directions of currents. In fact, the idea suggests itself that a properly constituted universe should exclude all rotary converters. We must have them at present, and they work satisfactorily, but they have no business to exist and we ought to be able to substitute for them some simple, inert machines, like stationary transformers. Buoyed by this hope we float along, catching at every straw that physics toys with in the direction of rectification, trusting that sooner or later we can build a 1,000-kw rectifier out of one of them, at a cost of a few dollars and some red paint. The aluminum cell rectifier was suggested and constructed on a small scale a few years ago. As soon as it was talked about we began to speculate upon the selling value of rotary converters. Nevertheless, the aluminum cell rectifier has not materialized, and we are ordering more converters than ever. Again, the mercury vapor, three-phase rectifier was exhibited, and again we thought of relegating our converters to their final scrap heaps. To-day, however, the mercury vapor converter is yet a matter for future development and the rotary converter still continues on its way rejoicing.

The last number of the *Physical Review* contains a paper in this direction on "Some New Rectifying Effects in Conducting Gases," by Mr. P. G. Nutting. The paper describes a number of experiments conducted upon the flow of electricity through rarefied gases, at electric pressures in the neighborhood of 1,000 volts. The results go to show that almost any dissymmetry in a gas tube, with respect to the positive and negative terminals, determines some degree of rectifying action. Thus, if one electrode is rough and the other smooth, or if one is hot and the other cool, etc., there will be some rectifying action. This action is stated to have varied from 5 per cent. to even 100 per cent. In the latter case, the dissymmetry consisted in having the two electrodes inserted in two different gas chambers connected by a fine capillary tube and exhausting the gas from one chamber only, so as to establish, during the process, a marked temporary difference of pressure, such as 4 mm. of mercury in one chamber and 0.3 mm. in the other. This particular plan does not seem very practical, but the fact that all of the alternating current in this case is stated to have been rectified, while in other cases a large proportion was rectified, suggests the hope of attaining a practical gaseous rectifier before very long. Indeed, the work of Cooper Hewitt along somewhat different lines gives promise of a direct commercial outcome.

THE USE OF SUPERHEATED STEAM.

The economical advantages of superheated steam have in a general way long been known to American engineers, but the subject is one which has been for the most part neglected here on account of more or less serious difficulties in lubrication to which altogether insufficient attention has hitherto been paid. Abroad and particularly in Germany the technique of superheating has been pretty thoroughly worked out, and very excellent results have been reached. German engine practice is looked at rather askance in this country, partly from sheer conservatism, and partly because German engines undoubtedly do look clumsy to American eyes. We are disposed to make a fetish of compactness on this side of the water and many a rather worthless article has been widely sold on the strength of its being compact and "self-contained"—this latter phrase being a characteristic American shibboleth. We even saw a cottage house once advertised as "self-contained." There is an underlying reality in this point of view residing in the fact that labor is much higher here than abroad, so that a relatively single and compact machine requiring very little attention is cheap to produce, and when in use may perhaps make up in freedom from care what it really lacks in economy. Be this as it may, high pressure, high compounding and superheating have made their way far more slowly in this land of dear labor and (formerly) cheap coal than they have in Germany.

In that land of attention to microscopic detail some very wonderful results have been reached by compound engines using superheated steam; and not satisfied with work upon stationary engines the engineers have gone carefully into locomotives fitted for superheating. The experiments on the State railways have now been going on for half a dozen years, according to a consular report just at hand, and have been rewarded by a very gratifying return in fuel and water economy. The superheater most in use is the Schmidt, and is placed on the smokebox, somewhat enlarged for the purpose. A part of the flue gases is shunted through the superheater, resulting in the utilization of the steam at 300° to 350° C. As found in practice, the gain is two-fold—first, in economy of fuel and of water, and second, in considerably increased output. As in the case of most data derived from locomotives, the results are subject to somewhat wide variations, but upon the whole the saving in coal is reckoned at 5 to 15 per cent., while the decrease of water consumption is relatively somewhat greater. The comparisons made have been in the main with compound locomotives, principally of the four-cylinder type, and in this case the decrease

of steam consumption is very perceptible and the fuel required is about the same. The statement made by one investigator that in the ordinary locomotive superheating reduces the steam consumption by about 20 per cent., is probably not wide of the truth. Compared with a compound locomotive, the simple locomotive with superheater proves to be at least equally economical of fuel, while giving equal power with a cheaper and simpler machine working with a lower pressure at the boiler. If further experience confirms these results, the superheater should find its way into American railway practice where compound locomotives, owing to their increased cost and complication, have never made much progress.

As to the difficulty of lubricating engines using highly superheated steam, our German friends do not seem to have been in the least disturbed. In fact, it is plainly stated that the earlier troubles in this respect have been quite overcome and the difficulty does not now exist to any material extent. Granted the fact that a considerable amount of superheating is desirable, it does not seem likely that lubrication will be a permanent obstacle. It exists in far more acute form in the care of internal combustion engines, but even here it is being met with a considerable degree of success, so that mere superheating becomes a matter easily to be dealt with. The advent of the steam turbine with its customary requirements of high vacuum and superheating will prove an educational opportunity, and the contest for supremacy between turbine and reciprocating engine is likely to be marked by great advances along lines that have been regarded as impracticable in the absence of necessity. Competition of this kind is wonderfully stimulating, and the three-cornered fight soon to be on, between the steam engine, gas engine and turbine, will hasten the solution of many difficulties. We, as engineers, are mainly interested in the application of superheating to large compound engines for stationary use. We do not believe that it should be neglected, however, in the case of locomotives. A single example of a locomotive with Schmidt superheater is to be found in Canada, and its performance will be very closely watched. Whatever the apparent result may be, the subject should not be dropped without further trials for a "freak" engine seldom gets a hearing altogether fair in the first instance. If the economic results of compounding can be attained in a simple locomotive of ordinary pattern merely by the installation of a superheater, a very considerable forward step has been taken in railway practice.

PSEUDO METRIC SYSTEMS.

Standing firmly as we do for the metric system, we view with a certain mild reprobation the publicity that has been given to some attempts at making an emulsion, as it were, of the metric system in our present mensurational Slough of Despond. It seems at first thought a specious proposition enough to standardize the pound at 500 grains, the yard at a meter divided into forty spurious inches, and to call the liter a quart. Such proposals have been made from time to time by various weak-kneed friends of metric measures, and to a certain extent have been tried, but to no good purpose. The yard and the meter are practically incommensurable. The one can be and is defined in terms of the other within the limits possible to science, but there is fortunately no simple relation between them. The only result, therefore, of mongrel compromises is to add to the very confusion which we wish to bury in eternal oblivion, and to preserve it indefinitely. We have far too many units of measurement now, and the principal reason for adapting the international metric system is in the interest of simplicity to wipe out half a dozen bad systems and get a good one in their place. A compromise system would neither get rid of the old nor secure the new. And even if it could get into use, to what purpose is it? At best a mere concession to dogged conservatism, having no reason for existence except to encourage the maintenance of a nomenclature that should be forgotten as quickly as possible.

We want to send the inch, foot and yard to join the line, the barleycorn and the ell in the scrap heap of civilization, and by no chance to prolong their useless existence after the metric system is fairly taken up. Antiquated and outworn units cling with a strange persistency at best, as witness the carat and the span, but they do perish in time and should go unmourned. The rod and the furlong are obsolescent even now. But any attempt to retain English names with specialized metric meanings merely makes a bad matter worse. The metric names themselves are entirely simple and systematic, and there is no need of others in practically using the system. The chatter of various inconsidering persons about the "natural" lengths of the English system and its "convenient" subdivisions is sheer nonsense, for the foreigner brought up under metric units finds ours almost inconceivably troublesome from its total lack of interrelation between its parts. We have the yard divided into three parts, the foot into twelve and the inch cut up on a complicated binary scale down to 64 parts, below which only decimal subdivisions are used. To add to these a pseudo foot and inch based on the meter would only make confusion thrice confounded. The names of the English units are not of the slightest value in themselves, nor are the particular lengths and weights denoted by them especially useful or convenient, save perhaps to those too shiftless to learn others. In point of fact, as every man familiar with the metric system practically well understands, it is a system quite as easy to think in as any other, and it is a matter of very little practice for one to get the knack of it, even with the disadvantage of previous knowledge of the so-called English system in all its stupid complexity.

A child picks up the metric system in a small fraction of the time required for the present muddle of tables, and once clearly grasped he can use it with entire facility. The alleged "convenience" of the inch merely means that the speaker knows practically no other small unit of length. Now, in the present earnest effort toward the final introduction of the metric system, let the real friends of reform waste no ink or breath on compromises of any sort. It will be quite impossible to kill off the old units in a day, or a week, or a year, but die they will in due season. The transitional period is not in the least to be feared except on the part of those who are determined not to learn, and for them we need have no sympathy. But let us not make the mistake of coddling the irreconcilables by fixing up for them a sugar-coated metric system. In the first place, it partakes of the Biblical vice of straining at a gnat and swallowing a camel—having acute qualms over a change of names, and then laying out a new and ingeniously complex system in addition to the half dozen we are trying to escape. In the second place, the anti-metric contingent will have nothing to do with any scheme which requires a conscious mental effort in learning something new. If it is new, down with it; and if it is both new and metric, cast it into outer darkness. There is small use in arguing with these opponents, much less in making any concession to them. They will use their old yardsticks and scales to the end of the chapter and compute with inward curses the fractions of a pennyweight required to make a gram, instead of using metric weights. Let the active friends of metric reform pound steadily away at their respective Congressmen, making no overtures to the enemy meanwhile, and when Uncle Sam once gets to work and uses the metric system in his business, the rest of the way will be clear. The present bill does not make the system compulsory with the public at large, but it will compel it to get some idea of the system used by the Government.

Programme of the Edison Electric Light Convention.

As previously announced, the twenty-fifth convention (twentieth annual meeting) of the Association of Edison Illuminating Companies will be held at Hotel Wentworth, New Castle, N. H., commencing Tuesday, August 30, 1904, at 9.30 a.m. A most successful convention is anticipated. It will be noted from the following list of papers that the subjects under consideration will be of great interest: "A Plea for Uniformity in Construction and Operation of High-Tension Systems," Philip Torchio, New York, N. Y.; "Notes on Economy in the Production of Steam," W. F. Wells, New York, N. Y.; "Experiences with Automobile Charging Stations," Joseph W. Cowles, Boston, Mass.; "Vulnerable Points in Operation of High-Pressure Alternating Transmission, Supplying Large Distributing Systems," D. L. Huntington, Spokane, Wash.; "The Relative Efficiency of Electric and Hydraulic Elevators," W. C. L. Eglin, Philadelphia, Pa.; "Electric Heating and Cooking," H. W. Hillman, Schenectady, N. Y.; "Relations Between Length of Arc, Voltage and Candle-Power in Enclosed Arc Lamps; and the Effect Upon Efficiency of Arc Lamps by Varying Size of Carbons," George N. Eastman, Chicago; "Gas Engines vs. Electric Motors," Fred. M. Kimball, Schenectady, N. Y.; "Light and Illuminating Engineering," W. D'A. Ryan, Schenectady, N. Y.; "To What Extent Should Central Stations Make Investments?" John F. Gilchrist, Chicago; "Results up to Date Obtained from the Use of the Wright Demand System of Charging," John W. Ferguson, Chicago; "Results up to Date Obtained from the Use of the Wright Demand System of Charging," Arthur S. Knight, Boston; "Some Commercial Problems," Joseph D. Israel, Philadelphia; "Notes on European Testing Laboratories," Dr. Clayton H. Sharp, New York; "Measuring Instruments in Generating and Sub-Stations," Caryl D. Haskins, Schenectady, N. Y.; "Troubles and Losses Between Generators and Customers' Services," P. Junkersfeld, Chicago; "Some Data on Electric Power," Arthur Williams, New York.

Hotel Wentworth is reached via Boston, thence by Boston & Maine Railroad, to Portsmouth, N. H., where conveyances will meet the train and transport the guests to the hotel. The rates are as follows: $4 per day; with bath, $1 per day extra, for one or two persons. It is hoped that the delegates will be accompanied by the ladies of their families. As in the past, there will be many feature of interest and entertainment which they will appreciate and enjoy. A golf tournament has been arranged and prizes have been offered. Mr. J. B. McCall, of Philadelphia, is president of the association.

Programme of the Ohio Electric Light Association.

The Ohio Electric Light Association will hold its annual convention at the West House, Sandusky, Ohio, on August 16, 17 and 18. As usual, a very full and interesting programme has been arranged, supplemented by various entertainments. The order of exercises is as follows:

Tuesday, August 16—Morning, 10 o'clock.—Roll call and presentation of candidates; reading of minutes of last meeting; president's address; announcements; executive session. Afternoon, 2 o'clock.—"A Day Load as a Factor in Central Station Earning Capacity," L. D. Hoit; "Notes on the Incandescent Lamp," E. H. Houghton; "Transformer Testing for Central Stations," S. E. Johanneson; "Relation of the Supply House to the Central Station," P. R. Boole; executive session.

Wednesday, August 17—Morning, 9 o'clock.—"The New Luminous Arc Street System," H. W. Hillman; "Notes on Incandescent Street Lighting," K. C. Randall; "The Important Relation of Electric Heating Devices to Central Stations," H. W. Hillman; "A Symposium on Central Station Heating," George Haler, Jr., E. F. Gwynn, J. A. Bendure, A. W. Field; executive session. Afternoon, 2 o'clock.—"The Steam Turbine and Its Use," E. C. Crocker; "The Instrument Equipment of a Testing Department," Frank Conrad; "Graded Costs of Electric Supply," M. E. Turner; "Points for Consideration when Purchasing Series A. C. Arc Lamps," G. Brewer Griffin; executive session.

Thursday, August 18—Morning, 9 o'clock.—"Unaccounted-for Current," W. E. Richards; "Voltage Regulation—Does it Pay? Why?" L. G. White; topic for discussion: "Joint Use of Poles by Public Service Companies," discussion opened by D. L. Gaskill, John H. Miller; executive session—report of the Executive Committee, report of the secretary-treasurer, report of the Finance Committee, report of the Advisory Committee, reports of the Special Committees, report of the Nominating Committee, election of officers; adjournment.

Arnold Railway System Test.

A trial trip was made August 3 over the Michigan Suburban Railway at Lansing, Mich., with a car fitted with the Arnold electro-pneumatic motor system. In this system, it will be recalled, a single-phase motor is used, the armature of which is always in motion. In starting, stopping or at any speed short of that corresponding to the synchronous speed of the motor, the field also revolves and drives, or is driven, by a compressed air engine. In the former case energy is stored as compressed air in a tank, and in the latter case is given out. By this means not only can a car be operated at any speed by the employment of single-phase current, but a constant load is kept on the power house.

The trial was made with the car equipment which was partly destroyed last winter in a fire which burned down the car barn where it was stored, the fire occurring a few days prior to the date set for a trial of the system. The machinery had been partly repaired, but owing to cracked castings a complete demonstration of the system was not possible on the trial. The object was to determine, as far as the damaged apparatus would permit, the control of the system and the taking of current from the trolley at 6,000 volts.

The car at times attained a speed of 25 miles per hour, and no difficulty at all was experienced even at this speed in taking current from the trolley. Mr. B. J. Arnold, who was present at the trial, expressed himself entirely satisfied with the control, which enabled speeds from the lowest to synchronism to be maintained and was very satisfactory in retarding and accelerating.

The system was completed about two years ago, but owing to a number of delays its trial has had to be deferred. Even at this date the trial trip back and forth over eight miles of line is probably the first case of single-phase traction over such a distance.

Electrical Service in Washington.

Mr. Walter C. Allen, electrical engineer for the District of Columbia, has submitted to Commissioner Macfarland his estimate of the amount of funds required for the conduct of the electrical department. He asks that the salary of James C. Simpson, superintendent in charge of the fire alarm, telephone and patrol system, be increased from $1,600 to $1,800 a year. An increase of from $720 to $900 a year is requested for each of the three repairmen in the department, and one additional repairman at a salary of $900 is requested.

The estimates contain an item of $20,000 for general supplies, repairs, etc. The current appropriation is $15,000. It is noted that the extensions of the fire alarm, patrol and telephone systems make this increase necessary. Only $25,000 is asked for placing wires of fire alarm, telephone and patrol system under ground, as against $35,000 appropriated by Congress for the purpose

For electric arc lighting and for extensions of this service the electrical engineer asks for $96,000, as opposed to $88,700 appropriated this year. For the purchase of fifty additional fire alarm boxes and for the erection of the necessary poles, etc., a new appropriation of $9,000 is asked. Mr. Allen states that no new fire alarm boxes have been provided for two years.

Mr. Allen asks for $5,000 with which to replace the old magneto telephone switchboards used in the District telephone system with the latest improved central energy switchboards, including new telephone instruments and apparatus. In commenting on this item the electrical engineer says: "The old magneto telephone system maintained by this department is obsolete and has become a source of constant trouble. The Chesapeake & Potomac Telephone Company has now abandoned its old switchboard of the same type as the District boards and uses only the central energy system. It is almost impossible to secure a good service with the two different systems, and as the bulk of the business on the District switchboards is through the telephone company's system, it is most desirable that the two should be uniform."

The Guanajuato, Mexico, Power Transmission—II.

BY ROBERT MCF. DOBLE.

THE POWER HOUSE.

THE first part of this article dealt in very full detail with the hydraulic part of the Guanajuato transmission, up to the power house and the delivery of the water to the turbines. The power house itself and equipment will now be considered.

The inside dimensions of the power house are: length, 200 ft.; width, 32 ft. The floor is of cement. A low wall separates a length of 40 ft. at the easterly end of the building, where the transformers are placed, which portion is two feet lower than the main room, and

FIG. 24.—POWER HOUSE AS SEEN FROM THE PIPELINE.

is provided with drains into the tailrace. There are two ten-ton, hand-operated cranes, which run the entire length of the building over both generator and transformer rooms. The erection of these cranes was an unusually simple matter. They were rolled into place from the surface of the ground and subsequently constituted the basis of a movable platform upon which the roof trusses were carried to place.

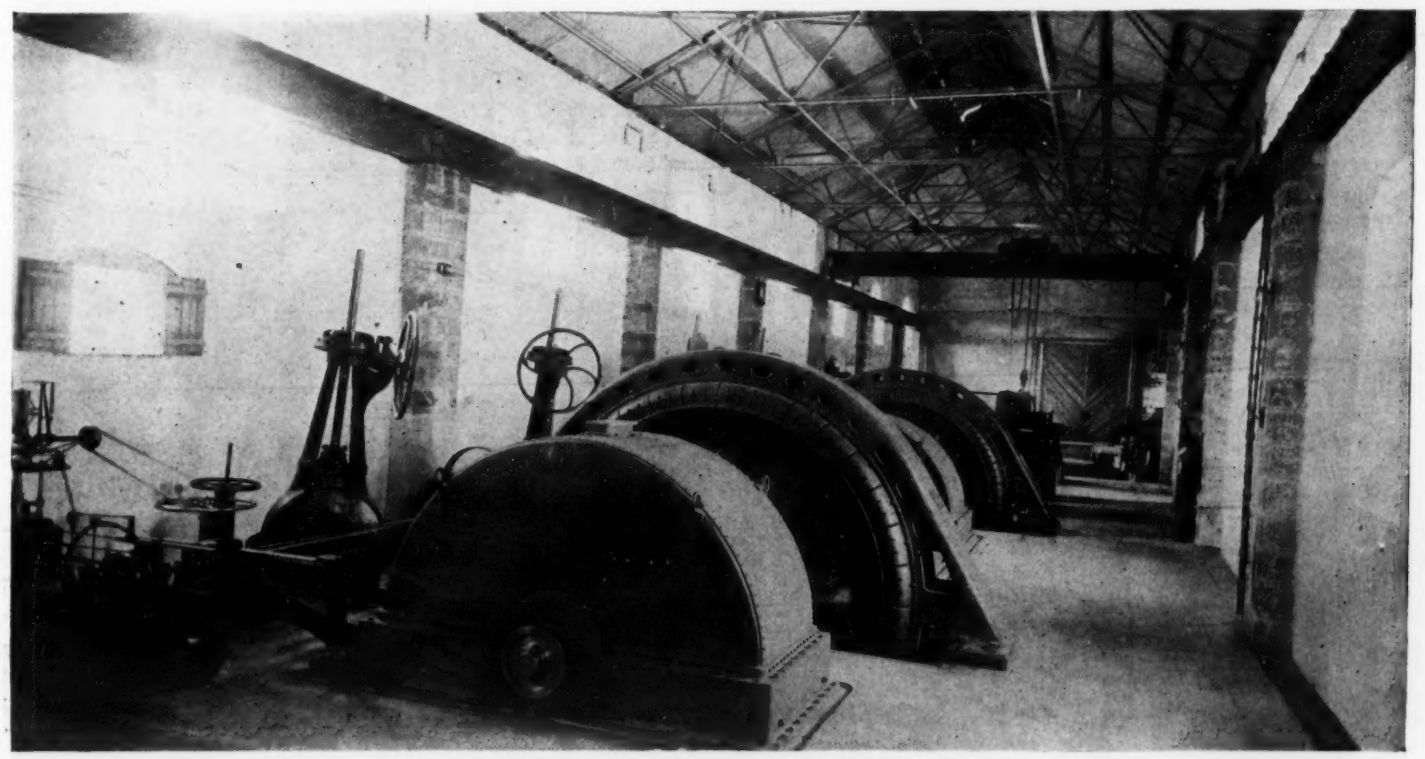


FIG. 25.—THE GUANAJUATO GENERATING PLANT.

The cast-iron branch pipes convey the water to heavy 30-in. gate valves equipped with by-passes. The nozzles are attached to the gate valves, as shown in the accompanying plan. These pipes are made of close-grained gray cast iron and have lip and recess bolted flange joints with lead gaskets and are entirely buried in concrete. The nozzles are curved in form, making a 45° bend, so as to bring the axis of the jet at right angles to the water wheel shaft. Each nozzle is provided with a removable tip, of cold blast charcoal iron, held in place by means of 14 7/8-in. Tobin bronze studs with steel nuts. The nozzle is of the needle regulating type, having a core piece movable axially within it by means of which the annular area of the orifice is changed. The core piece is a Tobin bronze stem with a phosphor bronze bulb fitting into the nozzle tip. A continuation of the stem through a gland in the convex side of the nozzle casting is threaded, and, by means of a bevel gear nut operated through a hand wheel stand, the needle is moved in and out to adjust the

FIG. 26.—VIEW OF TURBINES IN GENERATING PLANT.

quantity of water discharged by the nozzle, so that the maximum economy in the use of water may be attained. This construction produces a solid jet of good form and of high efficiency over a wide range of discharge. Each nozzle is equipped with a deflecting hood, operated through a system of levers by a governor, for regulating the speed of the generating unit.

The water emerging from the nozzle tips in solid jets more than half a foot in diameter at a velocity exceeding a mile and a half per minute, with a pressure of 138 pounds per sq. in., is projected into the buckets of the water wheels. The discharge into the tailrace and the Tamandaro aqueduct over the tailrace are shown in some of the views in the earlier part of this article.

Each water wheel has 15 huge buckets, more than 2 ft. in width and weighing 254 pounds apiece, made of close-grained, cold-blast charcoal iron. The buckets are accurately fitted to the rim of the cast-iron wheel center and secured thereto by means of two fitted

FIG. 27.—EXTERIOR VIEW OF GUANAJUATO POWER HOUSE, SHOWING TAILRACE.

steel stud bolts. The entrance edges are sharpened, the hydraulic surfaces are ground smooth and painted, and each bucket is brought to a standard weight so as to obtain a dynamic balance. The cast-iron wheel centers are machine-finished all over, bored taper, key-seated and secured onto the projecting ends of the generator shafts by means of a feather and a large bronze nut, as shown by the longitudinal partial section. The solid carbon steel shaft is 12 in. in diameter from the water wheels through the bearings, being enlarged to 16 in. diameter in the middle portion. The bearings are 36 in. in length by 12 in. in diameter, of ring-oiling, water-cooled type of special design.

The generators are revolving-field, engine type, 2,300-volt, three-phase, 60-cycle, 200-r.p.m. machines, rated at 1,250 kw, but designed for a 25 per cent. continuous overload. Their characteristics, as determined by factory test, are as follows: Full-load commercial efficiency, 95.77 per cent.; three-fourths load, 94.92 per cent.

Regulation at full load and 100 per cent. power factor is 4.4 per

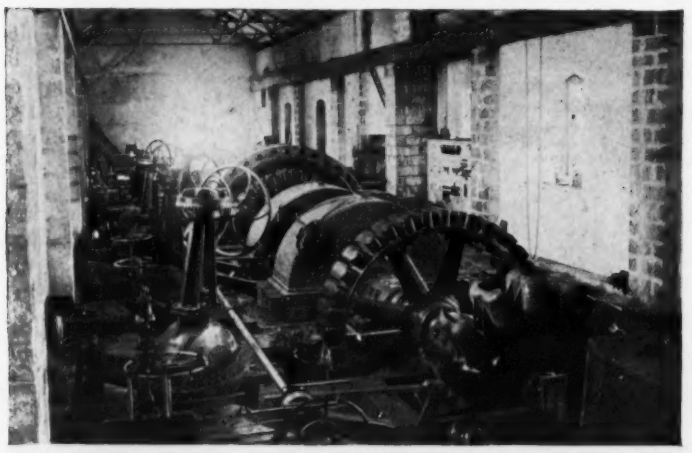


FIG. 28.—POWER HOUSE UNDER CONSTRUCTION LOOKING WEST.

cent.; temperature rise of armature, 21° C., after 6 hours' full-load operation.

The total weight of the revolving element, consisting of the field, the shaft and the two water wheels, is about 50,000 pounds, carried on two bearings. The speed is regulated by means of a governor, operated by an oil pressure system, actuating the deflecting hoods already described. The governors and the oil pressure pumps are belted from the generator shaft.

The General Electric generating units above described are conspicuous by reason of their compactness and simplicity, there being only the stationary armature, the electric and hydraulic revolving elements mounted on the shaft, and two bearings. The 1,250-kw unit occupies a floor space of only about 17 ft. by 25 ft. The assembling of such heavy machinery remote from shop facilities presented some difficulties, and in one of the engravings is shown the method employed for pulling on the revolving-field spider and the water wheels by use of specially long threaded steel bolts.

Continuous current for exciting the alternators is supplied by two 120-kw, 500-r.p.m., self-contained hydro-electric units, each of sufficient capacity to excite the four generators, so that one exciter is a spare. The exciter base is extended so as to receive the water wheel housing. The water wheel is mountd on the extended end of the shaft overhanging the bearing. Water is supplied to the wheel through a hand-regulating needle nozzle, being conveyed from the main branch pipe, as shown by the plan.

The current is conveyed from the generators to the switchboard, and thence to the step-up transformers, through lead-covered, rubber-

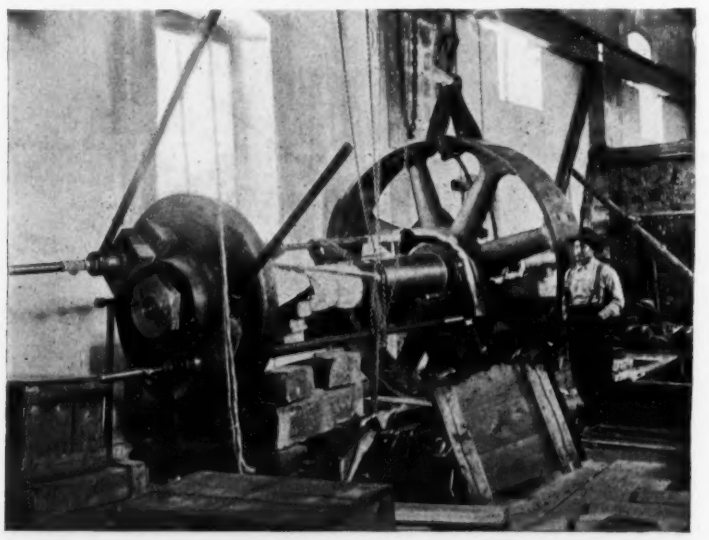


FIG. 29.—PUTTING GENERATOR SPIDER AND TURBINE CENTER ON THE SHAFT.

insulated copper cables laid in shallow-covered ducts in the cement floor. The current passes from the generators through 600-amp., oil-break switches, each installed in a separate concrete compartment, to the 2,300-volt bus-bars.

The field rheostats are supported on 4-in. I-beams above the switchboard and are operated by means of chains and sprocket wheels. The bus-bars, oil switches and wiring for the instruments are all back of the board and out of the way, being located in an alcove on the north side of the building, as shown in the plan and in photographs. The switchboard has seven marble panels, one for each of the generators, one for each exciter and one for two step-up transformer circuits.

reasonable price anyone may obtain the results of careful tests made by acknowledged experts.

From the switchboard the 2,300-volt current is conducted to the 1,080-kw static transformers, where the potential is raised to 60,000 volts for transmission. The transformers are delta-connected on the low-potential side and Y-connected on the high-potential side, having taps brought out through the top of the tank for line potentials of 40,000, 50,000 and 60,000 volts, the neutral being grounded.

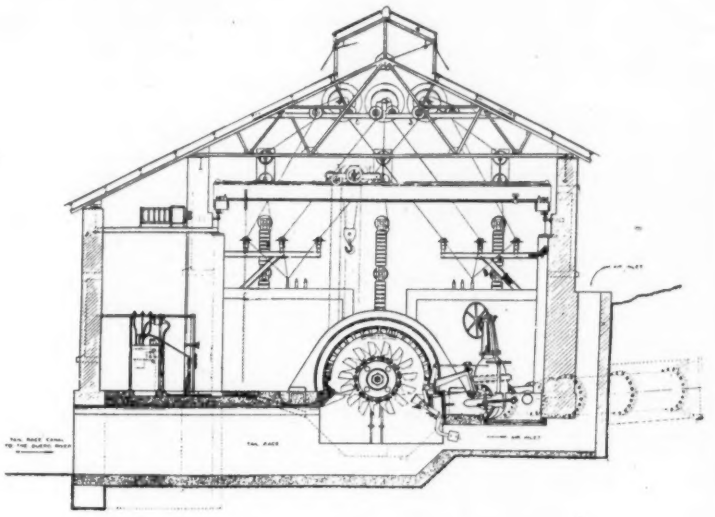


FIG. 30.—CROSS-SECTION OF GENERATING PLANT.

The efficiencies of the transformers as determined by factory tests are as follows: Full load, 98.295 per cent.; three-fourths load, 98.028 per cent. The transformers are of the oil-insulated, water-

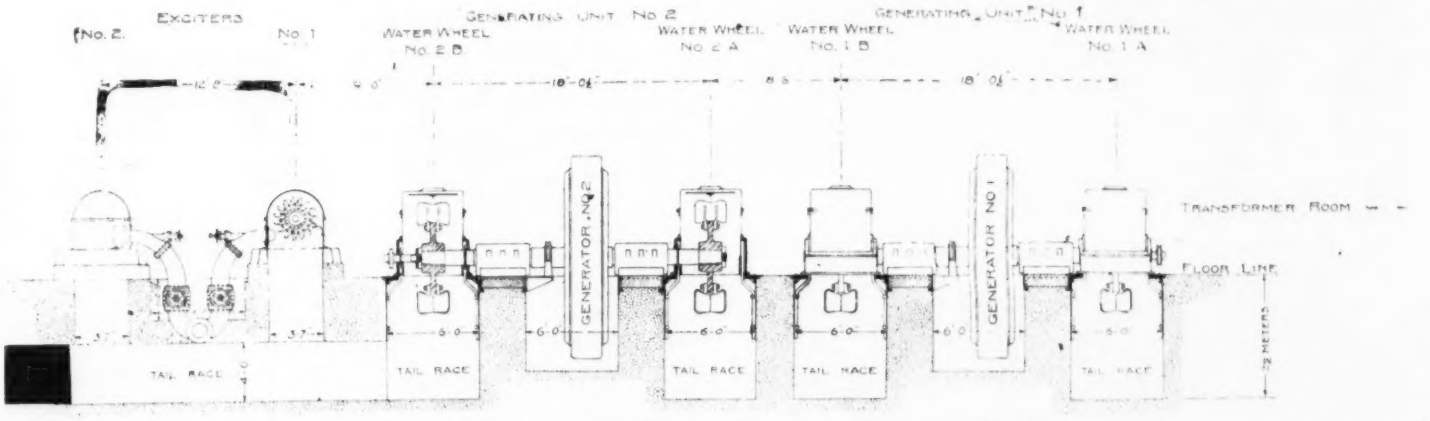


FIG. 31.—LONGITUDINAL PARTIAL SECTION OF GENERATOR ROOM.

cooled type; the tanks are 12 ft. in height and occupy a floor space of 3 ft. by 6 ft.

From the step-up transformers the current is conducted to the transmission line, the wires passing out of the building through circular openings in the wall to a set of 60,000-volt disconnecting switches, mounted just outside of the building and thence to the first tower of the transmission line.

On the inside wall of the building three rows of 60,000-volt lightning arresters are mounted, being connected through switches to the outgoing leads.

The Importance of Testing.

In a paper read by W. S. Howell at the recent annual meeting of the New York Electrical Society, some interesting statements are noted. Experience proves that careful buyers who test everything get better goods for the same money than careless purchasers who buy on faith, without tests. No better evidence of the truth of this assertion can be found than the practice of the great Pennsylvania Railroad Company. That corporation buys practically nothing without rigid tests. If continuous testing did not pay well for the great expense and effort it would have been discontinued years ago. This most careful purchaser gets not only the best of everything, but it gets the cream selected from the best, it gets it every time and all the time.

Another instance is that of the Navy Department, particularly the Bureau of Equipment, under whose jurisdiction all electrical supplies and apparatus for the naval vessels, yards and stations are purchased. All contracts are made under very rigid specifications, but many a manufacturer has learned a hard lesson by accepting a contract under the impression that the specifications were simply Government "red tape," or with the idea, born sometimes of self-conceit, that his product was "all right" and required no testing before being sub-

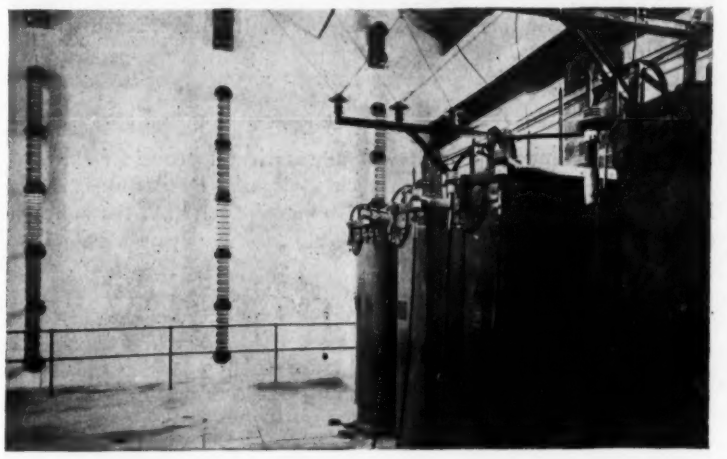


FIG. 32.—TRANSFORMER ROOM AT POWER HOUSE.

mitted. Many thousands of dollars' worth of electrical material and apparatus are rejected every year for failure to conform to its specifications. In most cases the cost of transportation alone of the rejected material, aside from the money loss, would have paid for proper tests. Incidentally, people can rest assured that this rejected material does not in every case go into the manufacturer's scrap heap. Somebody who doesn't test may get it—perhaps at what looks like a bargain at first, but how costly at last!

To the manufacturer, tests are of great benefit and are as necessary to a secure future as careful accounting. If you are not producing as high grade goods as your competitor, you should know where the fault lies; and the only way to know is to test. Perhaps you are quite sure you are making the highest grade goods, and that the other fellow is taking your trade only because he has a better selling organization or certain commercial relations beyond your reach, and you imagine that testing would add to your costs in greater ratio than to your benefits. A sad delusion, which will not help in the race. "Make your product as good as his, or better, prove your position by rigid tests, and your sales manager will soon see the results in increased business."

The value of tests lies in their accuracy and impartiality. The demand is for cold-blooded tests made by disinterested experts, who care only for facts accurately determined. Such tests, honestly reported without fear or favor and carefully guarded as the property of the customer for whom they are made, are of considerable value both to the manufacturers and to purchasers. To meet the demand for commercial testing, laboratories have been equipped where for a

Rigidance, a New Name for the Reciprocal of Capacity.

BY JAMES E. IVES, PH.D.

THE differential equation for the electrical disturbance of a circuit containing an inductance, L, a resistance, R, and a condenser of capacity, C, is, as is well known,

$$L\frac{d^2q}{dt^2}+R\frac{dq}{dt}+\frac{1}{C}q=0, \qquad (1)$$

where q is the quantity of electricity in the condenser at any time, t.

The solution of this equation shows that the disturbance will be oscillatory if

$$R^2<4\frac{L}{C}. \qquad (2)$$

For the present purpose, it will be sufficient to consider the *discharge* of a condenser through such a circuit. In this case, if the initial charge in the condenser is Q units of electricity, the solution of equation (1) will be given by

$$q=\frac{2Q\sqrt{LC}}{\sqrt{4LC-R^2C^2}}\,e^{-\frac{R}{2L}t}\sin\left[\frac{\sqrt{4LC-R^2C^2}}{2LC}t+\phi.\right] \qquad (3)$$

Equation (3) shows that the quantity of electricity, q, in the condenser at any time, t, is a sine function of the time, rapidly decreasing in value, as shown in Fig. 1. The damping depends upon the magnitude of the exponential coefficient, $\frac{R}{2L}$.

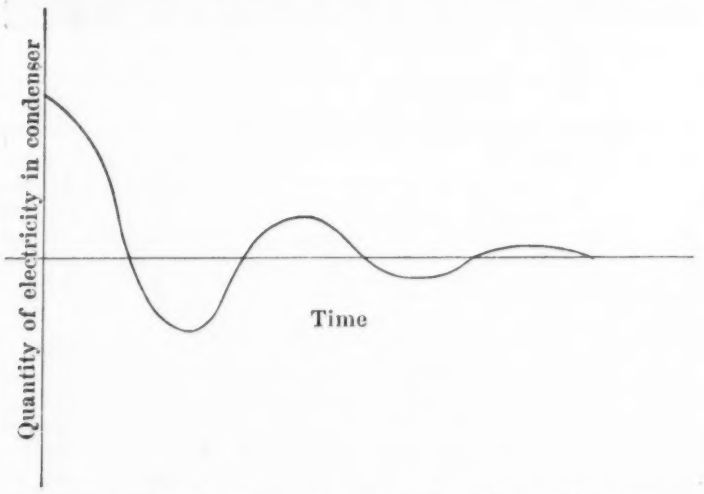


FIG. 1.—CURVE SHOWING OSCILLATORY DISCHARGE OF A CONDENSER.

The equation of motion of a simple mechanical system, such as a heavy bead attached to the middle point of a taut string (see Fig. 2), is:

$$M\frac{d^2q}{dt^2}+R\frac{dq}{dt}+Sq=0, \qquad (4)$$

where q is the lateral displacement of the bead, M its mass, F the frictional coefficient and S the coefficient of rigidity. R indicates the amount of energy lost by the system owing to molecular or other friction, and S the elastic resistance of the system to displacement of the bead.

It will be immediately noticed that equations (1) and (4) are of the same form, S in the latter case taking the place of $\frac{1}{C}$ in the former. The resemblance of the two equations suggests that the reciprocal of electrostatic capacity is analogous to mechanical rigidity. About four years ago, in the Physics Colloquium of Clark University, I proposed the name *rigidance* for the reciprocal of electrostatic capacity. I found afterward that Heaviside had already proposed the term *elastance*. It seems to me that *rigidance* is a more significant term, since the meaning of the word *elastic*, as popularly used, is notoriously vague.

If we use the letter S as the symbol for rigidance, equation (1) becomes:

$$L\frac{d^2q}{dt^2}+R\frac{dq}{dt}+Sq=0, \qquad (5)$$

and a complete analogy is established between the electrical and mechanical cases.

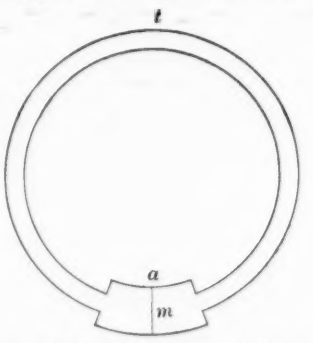
On the new assumption, we must consider a condenser as an electrically elastic membrane, its rigidance being the difference of potential between its two sides, when it has unit positive charge of electricity on one side and unit negative charge on the other.

FIG. 2.—MECHANICAL MODEL OF A CIRCUIT CONTAINING A CONDENSER.

It is hard to get away from the old idea of a condenser as simply a reservoir of electricity, but in view of the phenomena of oscillating currents, it seems to the author reasonable to regard a condenser as a diaphragm in the electrical circuit, which is distorted first in one direction and then in the other by the alternating current.

Such a circuit may be represented by the hydro-dynamical arrangement shown in Fig. 3, where t is a tube with rigid walls; a is a cylinder with a water-tight membrane, m, stretched across it. The tube t and cylinder m are completely filled with water. If now, by any means, the water in the tube is caused to move to and fro, it will produce a corresponding distortion of m, and we have a complete analogy to an alternating current charging a condenser alternately positively and negatively.

On the modern theory of a current as a mass of moving electrons we may regard the *rigidance* of the condenser as the reaction of the diaphragm to these electrons. The more rigid the diaphragm, the smaller will be the capacity of the condenser, and, other things being equal, the smaller will be the current.



..FIG. 2.—HYDRO-DYNAMICAL MEDEL OF A CIRCUIT CONTAINING A CONDENSER.

When the natural period of vibration of the circuit is the same as that of the impressed alternating disturbance, the current in the circuit will have its maximum value, and we have the phenomenon of resonance. In the case of the water circuit, the natural period of vibration will, of course, depend upon the mass of the liquid in the tube and the rigidity of the diaphragm.

The Relation of Telephone Traffic to Efficient Service.

BY HOWARD S. KNOWLTON.

"EFFICIENCY" is the battle cry of modern industrial progress. The all-important ratio of output to input is the symbol of operating economy. In the early days of any branch of applied science the great problem is to secure reliable, continuous service, and to later times are left the stopping of operating leaks and the improvements in detailed methods which annually save a great deal of money. To-day the elimination of waste, the saving of time, increasing of production in terms of a fixed amount of labor and material, and the standardization of products engage the attention of every industrial manager. Engineers are now practising who make a specialty of this work of improving ways and means and who give practically their whole time to the warfare against preventable losses.

Almost every great industry is now trying to save money by improvements in the methods of carrying on its business. The lumber camp saws its logs at the felling point of the tree by portable motor-driven machinery; the railway increases its train load per locomotive, and the manufacturer replaces belts and shafting by electrically-operated tools. In good times and bad the campaign goes on with energy.

The study of traffic is one of the most important phases of the work of securing operating economy. For a number of years past electric railways have been coming more and more to the practice of plotting load curves at their power stations at regular intervals,

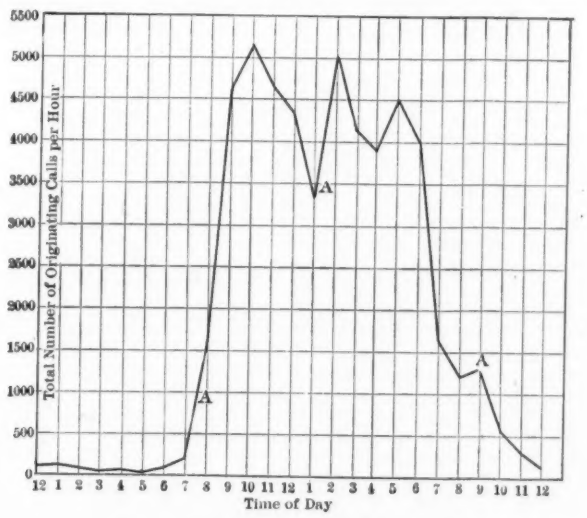


FIG. I.—TELEPHONE TRAFFIC CURVES.

counting passengers at important transfer points at different hours of the day, and studying the business of the various routes in its relation to the system as a whole. Electric lighting and power companies are also growing to favor a periodic examination of the volume of their traffic. The continuation of these records in graphic form throughout a series of months and years brings to light many interesting features of their developing business.

Perhaps no branch of electrical work offers greater opportunity for profitable traffic study than telephony. This is because of the enormous amount of detail which invests the business. The efficiency of the service is a direct function of the way the traffic is handled, and within certain limits it depends more upon the personal equation of the operating force than upon the equipment. Good operators can give better service with that which does not represent the latest design than poor operators can give with the most modern appliances.

Several methods of studying telephone traffic are now in force in this country. The most common way of determining the volume of business handled is to count every originating call at all the switchboards of a company's exchange for a twenty-four-hour period on a certain day each month. In case this day falls upon a Sunday or holiday the following business day is usually selected for the recording of the traffic. These monthly collections of operating statistics are known in the telephone world as "peg counts," and the information which they continually furnish is of the greatest value to the management. They show the increase or decrease of business in every class of service, whether it be "flat rate," "measured" or "nickel service," indicate the exact distribution of traffic throughout the switchboard positions; determine whether the operators are overloaded or not in comparison with others, and mark out the advancing policy of the company in line with the ever-changing requirements of business and social customers. Telephone traffic is, of course, partly local and partly toll, just as railway transportation is divided between freight and passenger business. Peg counts do not as a rule concern themselves with toll business in itself, as ample records of that branch of telephony are easily obtainable from the tickets which almost universally are filled out for each long-distance conversation.

The knowledge thus acquired of the amount of business being transacted from month to month is very helpful in maintaining a high efficiency in the operating force. It is very important that switchboard operators be guarded from both overload and underload in their work, for it has been demonstrated by experience that the character of the service reaches its highest point of efficiency when the operators are given enough to do to fully occupy their time, whereas on the other hand, if the operators are greatly overloaded, complete congestion and demoralization of the service are likely to ensue. Experience has also shown that if operators are strong in "team work"—that is, if they help one another in answering calls within reach whether the calls originate directly in front of them or not—the load per local operator may be increased almost to the point of congested service before the operator really becomes overloaded. This can only be accomplished after careful training, however, and a study of the traffic through what is known in telephone vernacular as the "joker" switchboard.

The "joker" switchboard is the *bête-noir* of every telephone operator. It is almost always located outside the operating room—sometimes near the office of the superintendent of traffic, and frequently in or near the room containing the main and intermediate distributing frames. By its aid the expert employee whose duty it is to analyze the service secretly "listens in" upon the circuit of any operator or subscriber connected to the exchange, and records in shorthand every detail relating to the handling of the calls and connections. As the operation of a large telephone switchboard is an exacting task, in the face of the service requirements of modern cities, it is important that all tests of the joker room be made without the operators' knowledge, in order to avoid their becoming nervous. In cases where tests cannot be concealed, it is good practice to explain their object in a bulletin to the operators, reassuring them that the good of service and not fault finding is what is aimed at. This applies more to long series of service tests than to "tabs" upon individual operators made for purposes of discipline and personal correction. The character of the service is greatly influenced by the coolness and self-possession of the operators. In every small exchange the question of discipline need not be carried to the lengths which city practice requires, but standard operating methods are as desirable in the country as in town. A joker room testing desk or switchboard may have 50 or more jacks, so that a number of service tests can be taken simultaneously. Only picked employees with unusually acute hearing and stenographic ability should be trusted to make the extensive tests which must be made in an exhaustive traffic study of a given exchange.

In making a careful study of telephone traffic it is necessary to gather a good many statistics. Among the figures which are of interest in this connection are the population of the community served, the number of telephones per hundred inhabitants, the number of subscribers per line, number of lines, number of operators' positions occupied at the switchboards during each hour of the day, average age and duration of employment of operators, classification of each type of service in terms of the number of telephone stations employed, etc. The peg counts show a great variety of data bearing upon the business of a given day, and these should be compared for many months back if they are available. So complicated is the traffic of a large telephone exchange that it is often necessary to treat traffic problems as engineering questions, and turn the data gathering over to the technical staff. The peg count is so called by virtue of a small plug with which operators keep tally of the incoming calls, moving the plug forward through successive rows of jacks as the calls are answered, each operator having a plug of her own and putting down an underlining work or reading at the close of each hour.

When a peg count is to be taken it is important that all operators realize just what is to be done. To this end the issuance of an explanatory bulletin is desirable. Great care should be taken to move the peg forward after each call rather than to wait until half a

dozen or even two or three calls have accumulated. Offices which have supervising operators are in a good position to secure accurate peg counts, as a considerable amount of checking can readily be done, which otherwise would have to be omitted. "Practice makes perfect" in this work as in everything else. It is probable that if the subscribers of many of the large telephone exchanges of this country were asked to name the date upon which these service tests are monthly carried out, they could not do it—so skilled do the operators become in handling and counting the traffic simultaneously. In fact, a visit to many an operating room on these days would disclose nothing unusually going on except to an acute observer. The operators handle their calls with almost the same facility as on ordinary days, and only the pressure of a small peg in the multiple jacks with an occasional noticed tally sheet below an operator's elbow indicate the making of the traffic record. In case it is necessary to separate the originating calls upon a certain group of lines from the others in the particular switchboard panel under consideration it is a good plan to mark the subscriber's drop or lamp signal, rather than trust to the operator's memory. Special columns should be provided upon the tally sheet for these purposes. Not long ago the writer had charge of a traffic count which was continuous for a period of one month, in a small country exchange, and the plan of marking the face of certain drops with a black cross was followed although the operators would soon have memorized the number which it was desired to separate. A count of such length is a tedious affair to the operators, but it was a necessity in this instance, in order to determine the relative traffic upon a certain typical group of rural lines and upon the other lines connected to the exchange in getting at the annual cost of service. The best practice in modern telephone offices gives each operator as little *special* work as possible.

An important feature of the peg count is its determination of the amount of traffic handled by different parts of the switchboard. The records should be taken over a sufficient period of time, however, to include one or two very busy days, and great care should be exercised as to their accuracy and operators thoroughly practised in team work before changes are made in the switchboard connections at the intermediate distributing frame. All calls originating at a subscriber's station should be recorded in the local switchboard tally, regardless of whether they are calls for trunk connections to another office, toll calls or local calls. The originating toll calls can readily be separated from local or trunk calls by the toll tickets. Trunking boards devoted to incoming trunk calls from the outside offices should be included in traffic records and keep a tally of their traffic, as well as local boards. The opportunity for errors to creep in is lessened if the operators' tally sheets are replaced and properly marked at the close of each hour. An example of some of the data which a recent properly conducted traffic count shows is as follows, some data being omitted for the sake of brevity:

TRAFFIC RECORD X TELEPHONE AND TELEGRAPH COMPANY.

Weather Fair. Common Battery Lamp Signal Switchboard.

Office.	A	B	C	Total or avg.	Diff. fr. last record.
Total No. subs. lines....	4140	1085	482	5707	+ 60
Total No. subs. stations..	7485	2494	1178	11157	+ 556
Total No. bus. stations..	5575	231	343	6149	+ 313
Total No. res. stations..	1910	2263	835	5008	+ 243
Tot. No. orig. calls 24 hrs.	58715	9084	4234	71997	+7650
Tot. No. orig. calls per line	14.1	8.3	8.7	12.6	+ 1.3
Tot. No. orig. calls per sta.	7.9	3.6	3.5	6.4	+ .4
Tot. No. outg'g t'nk calls	13215	6427	3149	22791	+ 567
Per c. of outg'g t'nk calls	22	71	74	31	— 3
No. "A" position hours..	563.5	111.5	69	744	— 28
No. "B" position hours..	81	47.5	20.5	149	— 2
No. operating employees.	138	25	14	177	+ 1
No. operating emp. hrs...	1009.5	206	117	1332.5	— 56.5

As the record shows, the office "A" is located in the business district, while the "B" and "C" offices are both in residence sections of the city served by the company. The "A" positions include those operators who attend to the local subscribers of each particular office, while the "B" operators are concerned with incoming trunk calls, in each office. It is interesting to note that in office "A" only 22 per cent. of the originating calls were for outgoing trunks, while in the residence offices "B" and "C" the outgoing trunk percentages were 71 and 74 respectively. This means a very large number of calls for down-town stations throughout the 24 hours. Another striking feature of the traffic is the number of calls originating at each station. Thus, the down-town office exhibits 7.9, while the two residence district offices are nearly alike at 3.5 and 3.6. The column of differences is a valuable part of the table to an operating company, showing as it does the change from the preceding month. The plotting of the results in curve diagrams brings them out still more emphatically in actual operation.

In the traffic record under consideration each class of service is also summarized somewhat as follows, taking the "flat rate" and "pay station" groups as examples:

FLAT RATE GROUP.

Office.	A	B	C	Total or avg.	Diff. fr. last record.
No. subs. lines	1222	151	64	1437	— 17
No. subs. stations.....	2017	176	90	2283	+ 4
No. orig. calls 24 hrs...	36911	2133	1044	40088	+4971
No. orig. calls bus. hrs...	4909	302	170	5381	+ 823
No. "A" oper. positions	19.5	2	1	22.5	
No. calls per station.....	18.2	12.1	11.6	17.5	+ 2.1
No. calls per "A" position business hours	251.7	151	170	239	+ 37

PAY STATION GROUP.

Office.	A	B	C	Total or avg.	Diff. fr. last record.
No. subs. lines	460	40	38	538	+ 6
No. subs. stations	496	49	41	586	+ 15
No. orig. calls 24 hrs....	4359	525	416	5300	— 257
No. orig. calls bus. hrs...	472	52	56	580	+ 25
No. "A" oper. positions.	4.5	.5	1	6	
No. calls per station....	8.7	10.7	10	9	— .7
No. calls "A" position business hours	104	104	56	96.6	— 4.1

Comparisons between different classes of service may be readily made as a result of the peg counts. It is unnecessary to reproduce

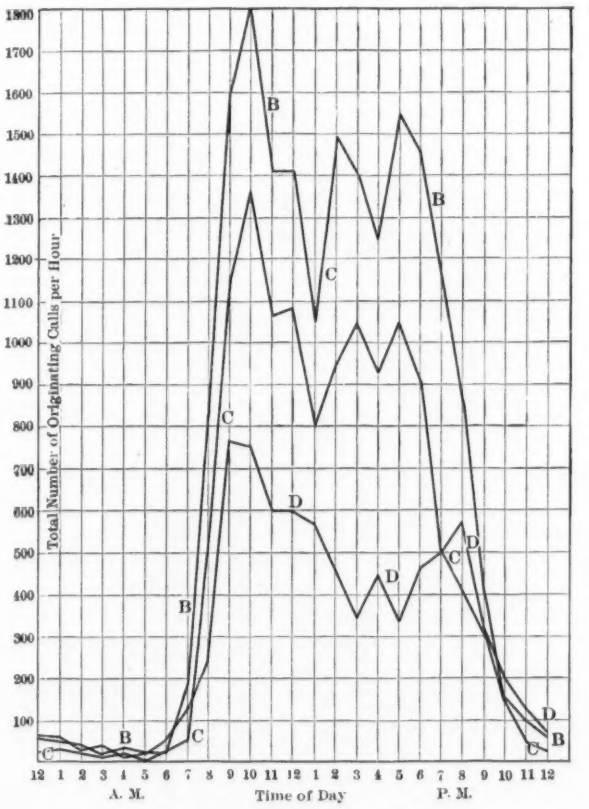


FIG. 2.—TELEPHONE TRAFFIC CURVES.

figures for the other classes of this particular case, as the object of this paper is to point out methods of studying traffic rather than to give concrete comparative results. The operation of different trunks should be carefully shown in these records, indicating the total number of incoming trunk calls in the 24 hours and during the busy hour, the calls per trunk of each kind in the busy hour, calls per trunk operator's position, etc. The detail sheets upon which these summaries are based are made up from the hour to hour tally sheets from the switchboards, and should show the state of affairs at every hour of the twenty-four upon the day on which the traffic record is taken. Care is necessary in properly labeling and filing all such sheets, as the day often comes when their recorded information is of vital importance to the operating company in determining the general trend of its complicated and ever-changing business.

An interesting method of checking peg counts is now in use by many telephone companies. It is called the "plug count," and is obtained by making counts at five-minute intervals throughout an hour of the number of answering jacks connected with answering plugs in every switchboard position; averaging these records to obtain the approximate number of plugs in average use during the hour, and then dividing this average number into the total number of originating calls for each hour in all the positions. The resulting quotient gives a constant or multiplier for use in later plug counts, so that after a number of tests of this kind are made the constant is determined with a very fair degree of accuracy, perhaps within two per cent., if the writer's memory is correct. In later counts the average number of calls per hour is determined by multiplying the constant into the number of answering jacks in use at any particular time. In an exchange serving a city of 27,000 inhabitants this constant worked out as 40 between 8 and 9 A.M., and 45 between 9 and 12 A.M., and 1 and 5 P.M. While this method is open to criticism in that it is based upon the very thing which it is designed to check, a large number of such tests carefully made really offer a good check upon the peg count records, the error bejng lessened as the number of tests increases, or rather, a better average is secured.

The actual operating service itself has a profound influence upon the traffic and is, therefore, worth considerable study. In making an analysis of the traffic for purposes of improving service which is not at the highest notch of efficiency it will often be found, by joker board tests and personal observation that operators do not help each other out well in team work; that numbers are repeated to subscribers either indistinctly, not at all, or in non-accord with the standard methods of enunciation adopted by the company; that operators do not use both hands with equal facility in plugging into jacks, ringing, etc., and that they lose time, both in answering originating calls after plugging in and after the calls have been flashed or rung by the subscribers. Then, too, it will generally be found that the traffic is unevenly distributed between different portions of the switchboard, and that as a result some operators have much more than they can handle, while others do not have enough work to keep them constantly busy. Considerable light is thrown upon the service by a large number of stop watch tests of the speed of answering, average length of conversations, time required to disconnect plugs after conversations are ended, time to obtain trunk connections, etc. Note is also made of irregularities in service, improper answers and repeating by operators, cut-offs, impertinent remarks by either operator or subscriber, the average time required for operators to plug in, ring the called subscriber, give the "busy" or "don't answer" report, interval between successive rings and the time to answer supervisory signals from subscribers. It will be seen that great skill is required to secure this data accurately. Inasmuch as the operators soon learn to recognize the person who makes "joker" tests if the company employs the same one in all its examinations of the handling of traffic, the writer believes it a better policy, especially for independent companies, to jointly maintain two or three skilled employees of this character, dividing their services in such a manner as to secure "rotation in office" and the utmost secrecy in regard to the time at which these tests are to be taken. Access to the joker room should be possible by some other route than the operating and retiring rooms.

The question of operators' loads is important and always bears investigation. Theoretically the limit of an operator's capacity to handle calls is determined by the average number of seconds which she has to give to each call, supposing team work to be effective also. In a case which came to the writer's attention this average was 7½ seconds during the busy hour, and the corresponding average maximum number of calls handled by the operator was nearly 360 per hour. This applies, of course, to local operators, and not to toll or incoming trunk positions. Even in times of heavy traffic it is improbable that all the operators of a group will be busy simultaneously, so that if team work is properly developed there will almost always be an operator within reach of a call to answer it promptly if the operators are sufficiently trained to answer every call within reach, regardless of whether the call originates in front or at the side. There are thus five operators within extreme reach of a call, on most large switchboards, and if all these fail to answer it there is till the chance that the supervising operator will transfer it to some less busy section of the board, in time to avoid serious delay. Where good team work exists, there should only be that decrease in the speed of operators' answering calls with increasing loads due to the slightly greater time required for operators to answer in the multiple or to plug into the answering jacks of adjacent positions. The operators should be so trained that there will be no delays in the service through an operator's being obliged to attend to a second call before completing the first. All classes of service are maintained at a high standing of efficiency by good team work. If an operator knows that a call originating in front of her will be handled by an adjacent operator if she is unable to answer it herself, she is in a position to give her undivided attention to each call.

The highest efficiency in handling traffic is secured when the service from all sections of the switchboard is as nearly the same as possible. To this end, therefore, all subscribers should be obliged to give the numbers which they require, rather than names; operators must not be allowed to gossip with subscribers or each other, and the fewest possible words should be aimed at. Discipline in the operating room is a matter of great importance. Lack of punctuality in taking positions at the switchboard, turning away from the board to look at visitors, snapping keys and pulling down connections by grasping the cords instead of the plug handles are some of the factors which are harmful to the service. Operators should never enter into disputes with subscribers; if subscribers persist in talking the proper course is to switch them to the chief operator or manager's desk.

In handling toll calls five important particulars are necessary to the proper recording of each desired conversation. These are: the destination of the calls, telephone number or name of person or firm called; name and initials of the particular person desired; name and telephone number of the calling party, and where and to whom the message is to be charged. It is of the greatest consequence that every employee engaged in handling traffic should realize that the time which the company sells in toll line conversations is extremely valuable, and that any needless delays in obtaining or destroying such connections work great harm to the service. Too much stress cannot be laid upon the expense of both plant and labor involved in long-distance traffic. The use of abbreviated language is, therefore, an advantage, particularly in companies which transact their own business by telegraphing over their toll lines. An example of the abbreviated list of common phrases for this time-saving purpose is given as follows:

A-B—Anyone who can talk business.
B-Y—Busy (meaning 'phone is busy).
C.-A—Cancel.
D-A—Don't answer.
O-F—One of the firm.
U—Out; will be back in — minutes.
U-D—Out; don't know when he will be back.
U-N—Unknown.
G-D—Not there; not expected back to-day.
K-N—Local telephone; sent to long distance.
N-G—Trying to get your party.
W-S—Leave word or left word to call.
M-S—Messenger started from — at — m.
N-C—No telephone; shall we send?
W-H—We have your party.
N-R—Nothing definite to report.
M-G—Messenger charge.
X—Will talk.
O-R—Give us a report.
A-G—Try again; we are ready.
H-P—Hold your party.
N-H—Not there (or does not belong there).

In small exchanges the complete phrase can be used with practically the same advantage as the abbreviation.

An interesting result may be easily plotted from traffic records, showing the hour to hour variation of total originating calls in different central offices. Curves A, B, C, D and E of Figs. 1, 2 and 3 illustrate the rate of calling for the following types of office:

A—Large city office located in business district.
B—Medium-sized office located in manufacturing city.
C—Office located in principal residential city.
D—Office located in residence district of "A" city.
E—Office located in village, summer resort (in winter season).

Considering the curves briefly, the tremendous increase in traffic about 8 A.M. is striking in every instance. The drop during the lunch period is evident even in the village exchange, E, although the residence district, D, is naturally much less affected at noon time than

the other offices. On the other hand, curve D shows a large use of the telephone for social purpose in the early evening—a factor which has little influence upon the traffic of the business exchanges. It is interesting to note the earlier forenoon maximum of curve D as exhibiting the hours of market and grocery ordering from residences, as well as the ascending rate during the afternoon in the same curve owing to the making of social engagements for the evening, etc. In every case the afternoon maximum is less than that encountered in the morning. The rush of business toward the close of the day appears easily in the 5 o'clock P.M. peaks of curves A. B and C, even

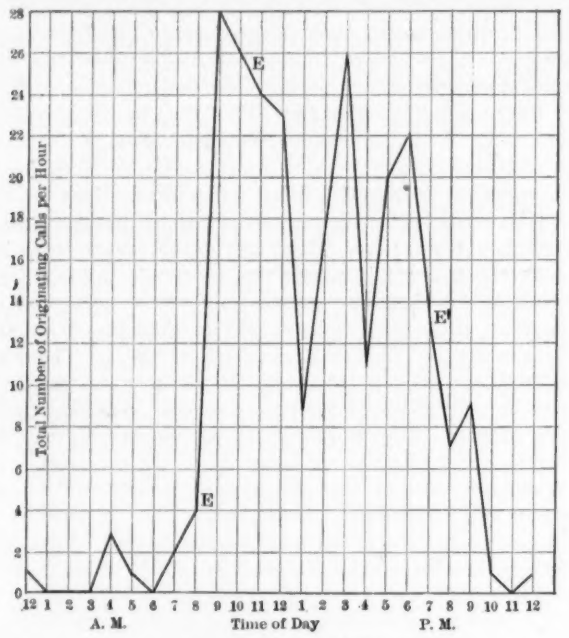


FIG. 3.—TELEPHONE TRAFFIC CURVE.

the village curve, E, being influenced by the haste as the working hours come to an end. Medical and other emergency calls probably constitute most of the night traffic in each office. The ratio of business to residence telephones for each office was as follows:

A—Business, 2.58; residence, 1.
B—Business, 1; residence, 1.43.
C—Business, 1.07; residence, 1.
D—Business, 1; residence, 9.8.
E—Business, 2.52; residence, 1.

The writer presents these curves for their comparison values, realizing that general telephone load curves have occasionally appeared in the technical press, but believing that fresh material enabling contrasts to be made, will not be taken amiss.

It will be apparent to even the casual reader that a great variety of curves bearing upon telephone traffic may be constructed with profit by operating companies. The value of such graphic statistics is constantly coming to be more appreciated by managers who desire to keep in closest touch with their business. Certainly the scientific study of traffic invites problems for solution which demand the throwing of light into every dark corner of the complicated industry which modern telephony is, and if the foregoing paper either offers any suggestions of interest or outlines the best practice of to-day to the operating telephone man, its object will have been attained.

Recent Electrochemical Developments.

MANUFACTURE OF CALCIUM CARBIDE.

One of the first important achievements of electric furnace processes was the production of calcium carbide from a mixture of burnt lime and ground coke. The simple reaction in this process is $CaO + C_3 = CaC_2 + CO$, but the temperature required for this reaction is above that of ordinary combustible-heated furnaces, and this is the reason why the electric furnace must be used. The desired effect of the electric current is nothing but heat. Hence, alternating current is just as applicable as direct current, or the former is rather preferable, not only on account of the easy transformation of alternating current, but for the reason that a direct current always tends to produce electrolytic decomposition, which is not desired in this case.

T. L. Willson, in his first experiments at Spray, N. C., used a direct-current arc, but found later that an alternating-current arc does the work just as well. At the works of the Union Carbide Company in Niagara, alternating current has always been used, of a frequency of 25 periods per second. W. S. Horry, as engineer of this company, has now found that the efficiency is the higher the higher the frequency. In a patent recently granted to him he proposes to employ an alternating current of the highest frequency that will not cause undue losses by excessive inductive voltage drop in the current mains. He thinks the reason of the greater efficiency of higher frequencies is that with low frequencies a certain amount of the molten calcium carbide and molten oxide is decomposed by each half wave of the alternating current, the energy consumed for decomposition being, of course, wasted.

NICKEL PLATING.

In the electroplater's art the rule of thumb long reigned supreme, but in recent years refreshing instances of the application of sound principles could be observed, and some of our best electrochemists have turned their attention to the principles of electroplating. In a discussion at an American Electrochemical Society meeting Dr. Louis Kahlenberg insisted that the prime requisite of getting an electrolytic deposit that will stick is that the metal to be deposited shall form an alloy with the metal on which it is plated. Dr. Kahlenberg later explained this principle in a longer article in *Electrochemical Industry* (February, 1903).

Many examples of the conscious or unconscious application of this principle in practice could be cited. Nickel may be successfully plated on copper, brass, bronze, since they easily alloy with nickel. On the other hand, lead does not alloy well with nickel, but with copper; hence, if an article of lead is to be plated with nickel, it receives first a deposit of copper and then one of nickel. The intermediate copper layer acts like a cement, since without it the nickel would not stick on the lead.

Similar difficulties are experienced with depositing nickel on iron. Iron does not alloy with nickel at ordinary temperatures. This problem presented itself to Mr. Edison in connection with his storage battery, in which all metallic parts—besides the active materials—are nickel-plated steel. He solved the problem by first depositing a layer of nickel on steel and then subjecting it in a non-oxidizing atmosphere to a welding temperature. Then at the points of contact the nickel will alloy with the iron and the nickel-plated film will practically be welded to the iron backing. A patent recently granted to J. W. Aylsworth refers to mechanical details of a method by which this process of Mr. Edison may be carried on continuously.

BATTERY INVENTION.

O. H. F. C. Weber has patented a storage battery plate which is first formed in the ordinary way by either the Planté or Faure process, and is then subjected to a temperature higher than the melting point of lead, so that the metal core fuses out of the plate; from the plate or grid only a thin, porous film remains on the surfaces which are in contact with the active mass, while the active mass itself is stated to be uninjured. The advantages are, of course, great lightness and easy access of the acid to the pores of the active material, but whether such a plate has any mechanical strength is another question.

A patent granted to I. Kitsee refers to details of construction of battery electrodes of limited area for use in small secondary and primary cells.

A patent granted to F. T. Cable relates to mechanical details of construction of storage batteries for use on launches and especially on submarine vessels.

J. P. Lough patents an apparatus for washing, cleansing and removing the accumulator sediment from storage batteries.

G. F. Webb patents a light and compact battery suitable for medical use.

MISCELLANEOUS.

The property of aluminum in certain electrolytes of readily permitting the passage of current toward it (i. e., as cathode) and interposing a high resistance to the flow in the opposite direction, is well known, and has been made use of for various purposes, notably for rectifying alternating currents and for constructing an electrolytic condenser. Mr. C. Hambüchen (*Transactions* American Electrochemical Society, Vol. IV, 1903) showed how this property may be made use of for electrolysis of solution by impressing an alternating e.m.f. on the terminals of the cell; by employing an aluminum and an iron electrode in fused sodium hydroxide, he obtained a cell which acted simultaneously as a rectifying cell and as an electrolytic

cell for the production of metallic sodium. A patent recently granted to W. Scheidel refers to a combination of an electrolytic interrupter (Wehnelt interrupter) with an electrolytic rectifier in one cell. The containing cell is made of aluminum and forms one electrode, while the other electrode is formed by a platinum point, a phosphate solution being used.

A patent granted to A. Schmidt and R. Müller refers to the manufacture of brominated indigo by electrolysis of an aqueous suspension of indigo or indigo-white treated with hydrogen bromide, sodium bromide, etc.

To the long list of processes for purifying water is to be added a method recently patented to W. M. Jewell, who removes sodium sulphate from water by adding barium carbonate and electrolyzing, this resulting in the precipitation of insoluble barium sulphate.

Gas-Driven Electrical Plant at Heysham Harbor, England.

For supplying current to arc and incandescent lamps and furnishing power for operating cranes, capstans, lifts, etc., the Midland Railway Company, England, has installed at Heysham Harbor, on the north Lancashire coast, a gas-driven electrical plant, which possesses several features worthy of note. The gas-generating plant, a view of which is given in Fig. 1, is of the "Mond" type. The Mond method of producing gas is to pass a heated blast of air and steam through the gas producer, in which it comes in contact with small bituminous coal at a comparatively low temperature and pressure. The steam employed for mixing with the air blast is the exhaust from the blower, pumps and auxiliary engine, these machines being supplied from two small boilers in a separate boiler house.

The producer itself consists of a main inner chamber lined with fire brick and the outer annular chamber through which the air passes before coming in contact with the furnace. The gas formed is a mixture of carbon dioxide, carbonic oxide, hydrogen, marsh gas and nitrogen, the carbonic oxide and hydrogen representing only some 38 per cent. of the whole. The carbon dioxide formed at the bottom of the producer where the air-blast enters is partly reduced to carbonic oxide, part of which is, in its turn, employed in the generation of hydrogen and carbon dioxide by the reaction between the carbon oxide and the water vapor.

Each of the two producers erected is rated for a maximum output of 750 indicated hp, and will deal with 7½ tons of fuel in 24 hours, producing 150,000 cu. ft. of Mond gas per ton of fuel, the calorific value of the gas being 150 B.T.U. per cu. ft.

In the engine room are at present placed three Westinghouse gas engines directly coupled to six-pole Westinghouse dynamos rated at 150 kw, and space is left for a fourth set of 300-kw capacity. As

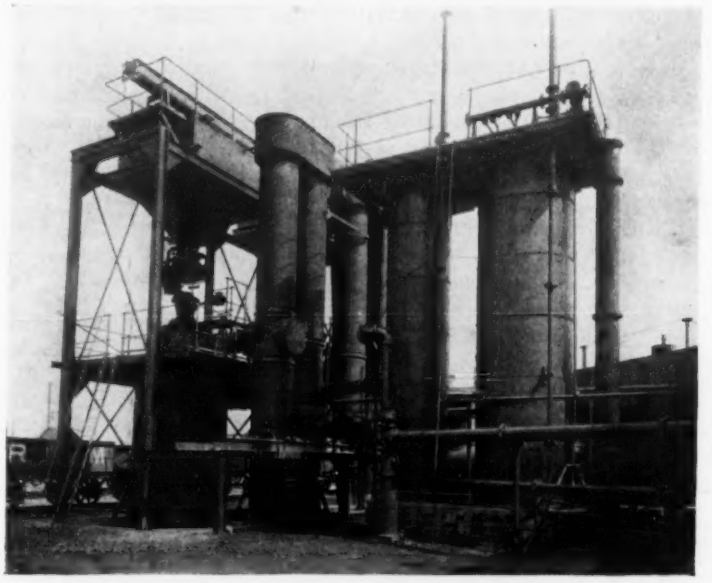


FIG. 1.—GAS PRODUCER PLANT.

seen in Fig. 2, the engine room contains also four boosters—two for the batteries, one for the lighting feeders and one for the power feeders. The battery boosters are automatically reversible, each consisting of a shunt-wound motor driving a 16-kw generator and a 5-kw exciter, a diagram of the circuits for which is given in Fig. 3. The exciter on the end of the shaft is differentially compound-wound, one of its field windings being connected to the bus-bars and the other to a very low-resistance shunt in the bus-bars between the main generators and the outgoing feeders. The boosters have also on their fields a series winding carrying the main current, thus causing a cumulative effect to take place.

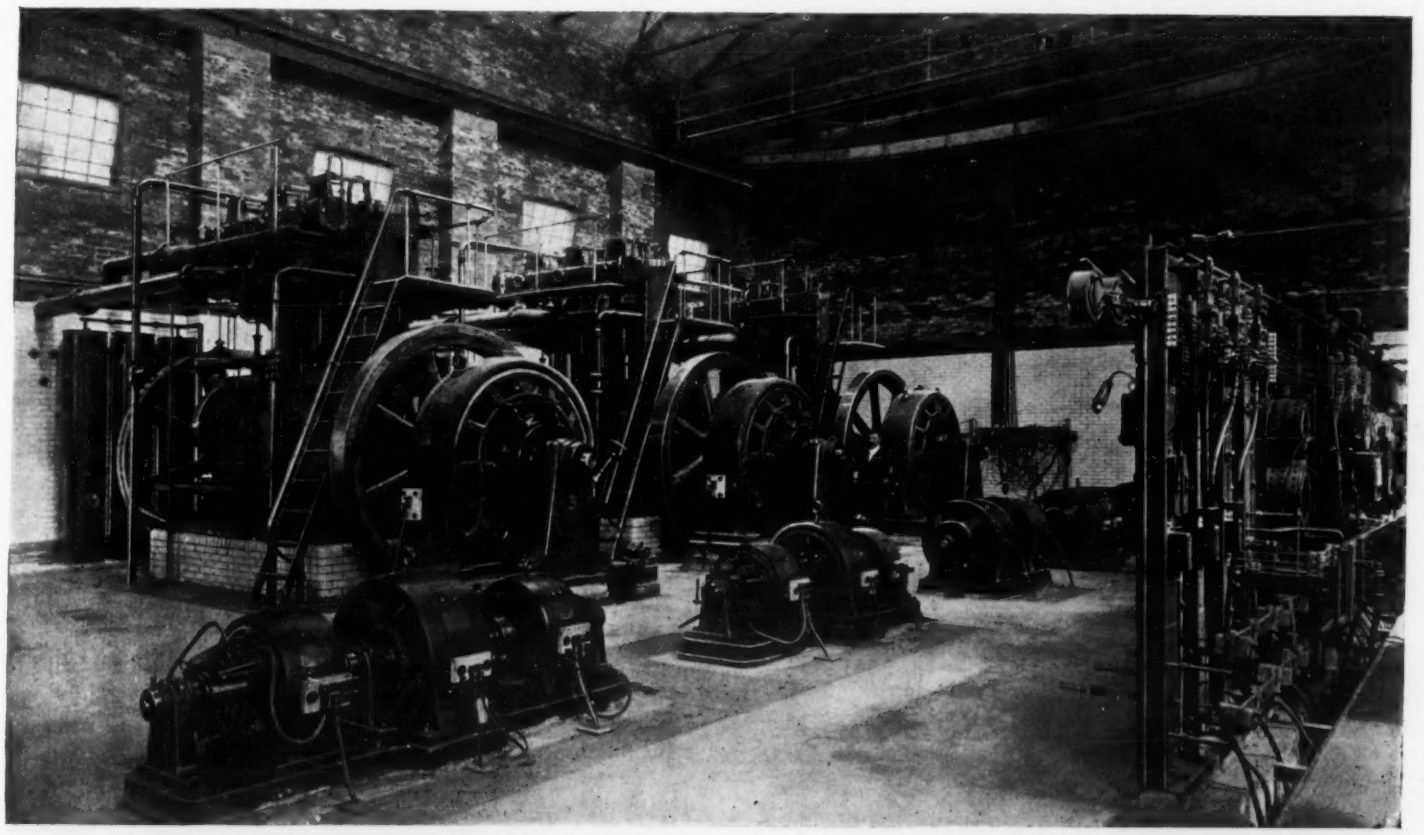


FIG. 2.—GENERATING ROOM, HEYSHAM HARBOR.

The lighting feeder booster is made up of two 7½-kw series generators driven at 850 r.p.m. by a shunt motor. The machine is

designed to increase the pressure by 25 volts on each side of the lighting feeders, when necessary, and to deal with a current of 300 amp. Each of the generators of this machine has, in addition to the series winding, a second series winding in series with the middle wire, as shown in Fig. 3. Thus when there is an out-of-balance current flowing through the middle wire, the pressure on the more heavily loaded side is automatically increased, and the middle wire drop is compensated for.

In view of the fact that there may be occasionally considerable overloads on account of the number of crane, capstan and lift motors, and the fact that the generating plant is gas-driven, a storage battery of generous capacity has been installed. The battery consists of 230 cells, capable of supplying 180 amp. for six hours or 540 amp. for periods not exceeding 30 seconds.

The cranes are worked by series motors of the traction type. Each of the twelve capstans erected in the harbor is provided with a 20-hp

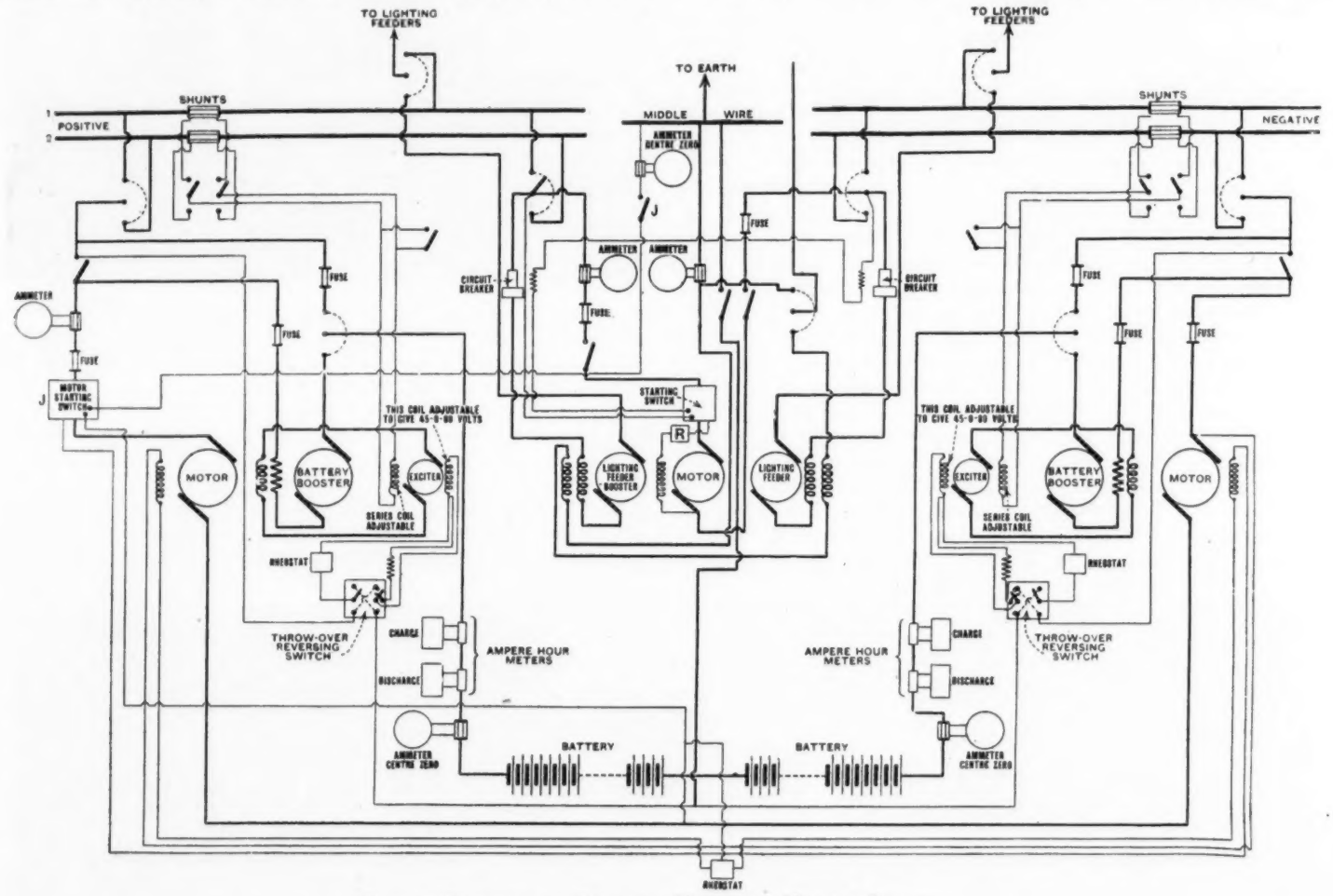


FIG. 3.—DIAGRAM OF CIRCUITS, HEYSHAM HARBOR PLANT.

compound-wound motor, and starting gear of a special design. Shunt motors are used for driving fire engines, a switch being provided in the pump room, by means of which the fire engine electric mains may be connected directly to the battery should a fire occur on the switchboard or in the engine room and cut off the supply of power to the fire engines.

In consequence of the tidal rise, the two Waywood lifts, which are provided for taking passengers and goods to and from the upper and lower landing stages, are provided with water-level cut-offs, so that it is impossible for the lift to come down to the lower level landing stage when this is below water. These low-level landing stages necessitated special precautions being taken as to insulation of the lighting circuits, the lamp and cover being enclosed in a thick glass cover cemented into an iron ring, which is fixed in a water-tight manner to the top of the fitting with the aid of a rubber ring.

Railroad Telephony.

A report from Philadelphia says that the Pennsylvania Railroad will use the telephone on its block system on the new West Pennsylvania instead of the telegraph.

Relation of Trunk Roads to Trolleys.

A young man who was interested in a city gas plant at the time when asked, says the *Wall Street Journal*, what would be his policy toward electric lighting, which was then coming into general vogue, replied: "We are here to do business. If the people want electric light they shall have it, if they want gas light they shall have it, if they want candle light they shall have it." Something of the same attitude has been lacking at times in railroad policy. The railroad operates under certain restrictions, but its economic function is transportation in a broad sense. In the problem, that of moving freight over the prairie, across the mountains or over the ferry, into the city or out of the city, or through the city, at high speed, at low speed, at luxurious standard of service, at low standard of service, by steam, by air, by electricity—the aims and policy of the management should be conceived in the spirit that they are "here to do business."

So far as possible throughout the whole field of transportation, if they do not control it they are at least the factor to be reckoned with in the evolution of a general system of transportation service. New methods and new interests will invade the field, but they will find it to their advantage to discover and take up the complementary relations where they can best serve with the existing transportation system.

The advent of the trolley has brought much confusion among steam roads. The original chaotic competition among steam roads had gradually given way to a well-systematized transportation service, with competition along settled lines of policy. The possibilities and real functions of the trolley were indefinite, its claims and results contradictory. Its whole status rendered it an uncertain factor which the railroads, acting upon instinct rather than upon intelligence, set out to fight indiscriminately.

It is certain that there are varying conditions under which the transportation service is rendered which require modifications of physical standards. The trunk line standard is not the one for the branch line, and the branch line standard may yet be a cumbersome and awkward one for the secondary branch lines. Railroads with foresight have in places entered into the question of local accommodation of passengers at large terminals by establishing cab services, baggage and parcel transfer systems. At Atlantic City the Pennsyl-

vania has taken possession of the local trolley situation and harmonized schedules with steam railroad requirements. At other points, for instance, as at Boston, where the steam and trolley are separate interests, the public is not convenienced by such little complementary adjustments. The time is coming for a definite stand and clear, long-headed policy in these particulars.

New Telephone Patents.

TWO GRANULAR TRANSMITTERS.

A granular transmitter in which all the electrodes are stationary has been patented by W. Kaisling, of Chicago, and assigned by him to the Stromberg-Carlson Company. In this transmitter there are four gold-plated brass electrodes symmetrically disposed within the insulating back of the carbon chamber. In front and in contact with these is the granular carbon, which also lies against a plunger flexibly mounted within the chamber, and driven back and forth by the diaphragm. The electrical circuit is from two oppositely-placed elec-

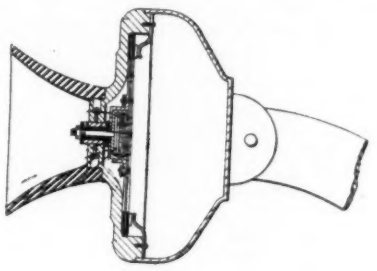


FIG. 1.

trodes connected in multiple through the carbon to the other pair of electrodes, also connected in multiple. The conductivity of this circuit varies with the varying pressure of the plunger upon the granules. Freedom from packing is one of the inventor's chief claims.

A second transmitter patent, assigned to the Stromberg-Carlson Company, is one issued to Rasmus Hassen. The transmitter forming the subject of this patent is novel in that the familiar bridge piece, so universal in transmitters of the general "solid-back" type, is here omitted, as the transmitter button is mounted in front of the diaphragm. To this end the front piece of the casing is extended forward to form a support for the button. The general arrangement is shown well in Fig. 1.

SELECTIVE SIGNALING.

A six-party selective signaling system has recently been patented by William M. Davis, of Chicago, which depends for its operation upon the use of direct current for four of its stations. At these stations, polarized, interrupted circuit-vibrating bells are used, one of each polarity being tapped to ground from each side of the line. By this means any one of four stations may be selected exclusive of the others. For the remaining two stations ordinary alternating-current polarized bells are used, one wired to ground from each side of the line. These latter are rendered entirely insensitive to the direct current because of a condenser connected in series with them, and on the other hand the direct-current stations are made insensitive to the alternating current, for at each a heavy retardation is wired in the ground tap. No other special apparatus is required for this system at the subscribers' stations, and the extra apparatus at the central office includes merely the ringing keys and the direct-current generator. Mr. Davis has assigned his patent to the Stromberg-Carlson Company.

A second patent for a selective system is one granted to J. J. Comer, of Partridge, Ill. Mr. Comer's system is virtually of the step-by-step type, the operation of selection depending upon the proper manipulation at each station of two selecting armatures. These armatures move in a common field, one constrained to move in one direction only and the second in the opposite direction. One of the armatures carries a pin adapted to move a contact anvil into operative position, this pin having a relatively different angular position at each station. Springs tend to return the armature to the zero position, but this movement is prevented by ratchets and pawls. The contact point, which must strike the contact anvil at each station, and which, through such contact, controls the ringer circuit, is moved by the second armature. This armature responds to a reversed current impulse, and not only raises the contact point, but also releases the ratchet of the first armature. The operation will thus be seen to be as follows: A proper number of impulses rotates all the first armatures, but carrying the contact anvil at the desired station only into the path of the contact point. A reversed impulse actuates the second armatures, raising the contact points, but meeting the contact anvil at the desired station only. This latter impulse is maintained as long as it is desired that the bell shall ring. Simultaneously with the closing of the circuit at the desired station all first armatures are released and return to zero, while upon the cessation of the ringing current the selected station contact anvil is released and returns to the normal position.

SERVICE-REGISTERING APPARATUS.

After the unsatisfactory trial of a number of call-registering systems by some of the larger operating telephone companies, a system was adopted wherein the registration of a call is accomplished electrically, but directly under control of the operator handling the connection, the call counter being located at the central office. In this system the registers are associated with the various subscribers' lines, while the controlling key is connected in the connecting cord circuit. In addition to the line meters, there is provided also an operator's meter, which indicates the total number of calls counted at her position. The counting apparatus and circuits of this system are set forth in a patent granted to Messrs. C. E. Scribner and F. R. McBerty and assigned by them to the Western Electric Company. Fig. 2, taken from the patent drawings, shows in the upper right-hand corner two views of the meter, while the circuit diagram occupies the remainder. In the circuit are shown one-half—the answering part—of a pair of connecting cords, and the answering jack part of a subscriber's line. The fundamental circuits are those of the standard Bell switchboards. The line meter shown at *C* it will be noted is double-wound, c^1, the winding permanently bridged around the cut-off relay, being of high resistance, and the winding, c^2, controlled by the contact of the meter armature, being of low resistance. The relation of these windings to that of the cut-off relay is such as not materially to shunt it. When the push, *k*, is operated, shunting out much of the apparatus of the cord circuit, a sufficient current passes to actuate the meter, *C*, but not sufficient to operate *l* or *m*.

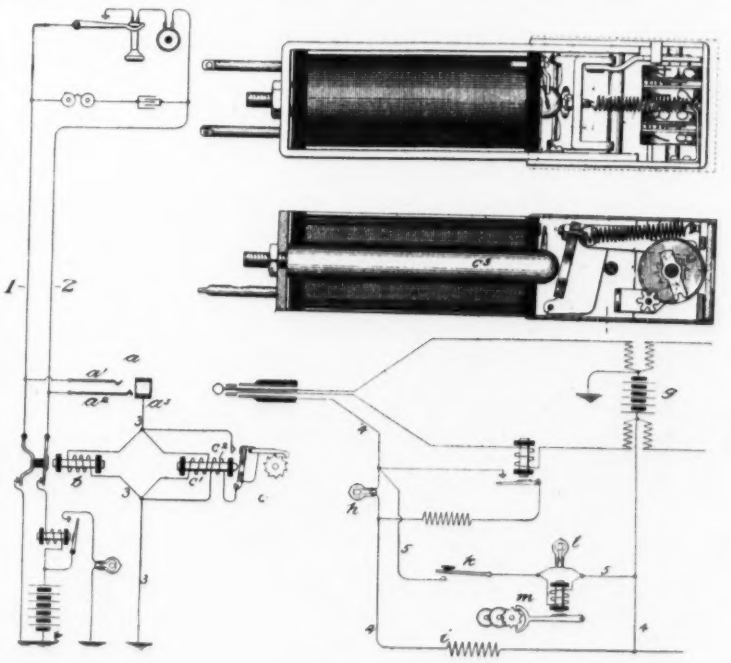


FIG. 2.

C operates and closes circuit c^2, thereby materially increasing the sum total of current passing. This increased current operates *m*, the operator's meter, and *l*, her pilot lamp, which thus indicates the proper actuation of the line meter.

PLUG SOCKET SWITCH.

Plug socket switches have in the past proved most unreliable for various reasons, and they are, therefore, now avoided wherever possible. Nevertheless, the appearance of a thoroughly reliable one would come as a boon to circuit designers. A new socket switch

has recently been patented by William Kaisling, which looks encouraging, as it conforms quite closely in general design to the modern switchboard key. In this case the plunger, or wedge, is attached to a tube through which the cord extends and upon the top of which the plug seats. When the tube is depressed by the pull of the cord weight, the wedge is depressed to extend the switch springs. The Stromberg-Carlson Company has obtained this patent by assignment.

INTERCOMMUNICATING SYSTEM SWITCH.

A switch for intercommunicating systems which combines automatic restoring as well as a lockout feature, has been patented by Messrs. A. K. Andriano, of San Francisco, and H. Herbstritt, of New York City. The switch is placed manually in any desired position, but if the line corresponding be busy the circuit of the calling station remains open even after the telephone is removed from the hook. When the telephone is restored the switch is automatically released.

AUXILIARY APPARATUS FOR TELEPHONE SYSTEMS.

Few not having the actual records at hand appreciate the large percentage of time that telephone lines and apparatus remain idle. Nevertheless, quite a large proportion of the charges in message rate working is attributable directly to this period of idleness. Suggestions have from time to time been made for the combined use of lines for both telephone and other service, but as yet little has been done in this direction. That something is being done, however, is evidenced by the appearance of a patent for apparatus for use with such a combined system. At the subscriber's end the auxiliary apparatus, such as an open-circuit, fire alarm, messenger call system, is wired directly to the telephone line, intermittently connecting both sides of it to earth. The receiving apparatus at the central is not connected to the line directly, but is controlled by a differentially-wound relay, with one winding included in each side of the line. This relay is insensitive to the telephone signals, as these pass through both windings. The auxiliary signal currents, however, pass through one winding only, viz., that ungrounded at the central office. Mr. W. W. Dean is the patentee of this system.

TELEPHONE EXCHANGE SYSTEM.

Mr. J. P. Downs, of Cleveland, Ohio, has devised a system of exchange circuits especially designed to avoid "clicks." These circuits are so arranged that there is no complete break in the circuit at any time, the various circuit changes required being effected by shunting the various circuits together. To avoid excessive consumption of current the supervisory lamp circuits are controlled without the use of shunts.

TELEPHONE REPEATER.

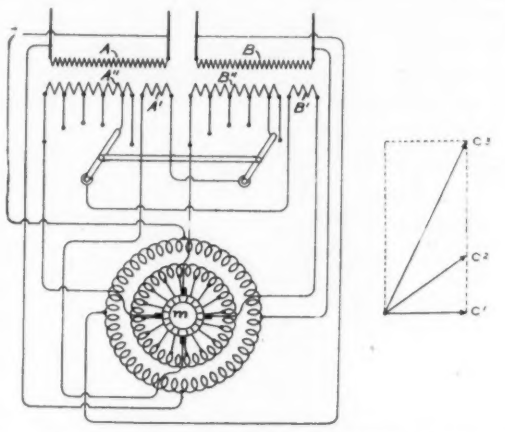
Another telephone repeater has been invented, this of the telephone-microphone type. The receiving coil is in two sections, these being wound outside a primary winding upon a single core. The poles of the core are confronted by diaphragms which close one end of each of two sound chambers. The diaphragms at the opposite ends of these chambers actuate microphone buttons, which in turn are included in series in the primary circuit. The telephone line is connected directly to the secondary, one side to each section. This repeater is the invention of D. H. Wilson, of Chicago.

Control of Alternating-Current Motors.

If there be available voltages of any value from the individual secondaries of two transformers whose primaries are connected to two-phase supply mains, these voltages may be combined in such a way as to produce a resultant having any value and phase position desired. This fact furnishes the groundwork for two patents issued August 2, 1904, to G. Winter, F. Eichberg and J. Alexander on method and means for controlling alternating-current motors. The method of control is applicable to motors supplied with current in both the stationary and rotating members and is intended to compensate for the change in the relative phase positions of the currents in the two members when the e.m.f. impressed upon one is altered for purpose of speed control.

As seen in Fig. 1, the stationary winding of the motor is tapped at 90° intervals and fed with current directly from the two-phase supply mains. The rotor, which is equipped with a commutator, is likewise fed with two-phase current, the value and phase position of the e.m.f. impressed upon the commutator being variable at will by means of the mechanically interconnected transformer switches. The effect of moving the switch arm shown in Fig. 1 will be appreciated from a study of Fig. 2, which represents the e.m.f. impressed upon a single pair of brushes in Fig. 1. $O\,C'$ is the constant value of e.m.f. from the unvarying portion of one transformer secondary, while C^1C^2 or C^1C^3 is the e.m.f. series connected therewith from a portion of the secondary coils of the other transformer. That the resultant impressed e.m.f. will have the relative value and phase position shown by lines $O\,C^2$ or $O\,C^3$ needs no proof.

The torque exerted by each of the two (phase) elements of the motor will be proportional to the product of the armature current and the field magnetism in mechanical quadrature therewith and in time phase with it. The value of the armature current is determined directly by the effective e.m.f. acting at any pair of brushes and inversely by the impedance of the armature circuit. The effective e.m.f. has a value and time phase position depending upon the difference between the e.m.f. impressed at the brushes and that countergenerated by the transformer action of the magnetism in mechanical line with the brushes and by the dynamo speed action of the magnetism in mechanical quadrature with the brushes. Thus by shifting the time phase of the impressed e.m.f. and altering its value at will, the armature current may be given any value and relative phase position desired, so as to produce at all times maximum torque for the apparent energy input or to compensate for the primary exciting current under speed conditions.



FIGS. 1 AND 2.—CONTROLLING CIRCUITS AND E.M.F. PRODUCED.

A disadvantage in the method when applied to traction motors is found in the requirement for a source of supply of polyphase current, necessitating more than two line conductors.

University of Minnesota Theses.

An idea of the nature of thesis work being done at the University of Minnesota may be gained from the Year Book of the Engineers' Society of that school, which gives in abstract the theses of several of the engineering graduates. The alternating-current railway motor seems to have received considerable attention on the part of the graduates, five men having studied the various types which have been proposed for this work—the Schüler type of repulsion induction motor, the Lamme type of transformer compensated and resistance dampened motor and the Ryan (Deri) type of forced compensated motor. The Schüler motor possesses the advantageous characteristic of being able to return energy to the supply system when driven above synchronism, as in descending grades. The thesis work shows that for low frequency the Ryan type of compensated motor can be designed to operate at very high power factor and without detrimental sparking at the commutator, giving a performance closely equivalent to that of the direct-current series motor.

Other interesting thesis work dealt with the measurement of telephone currents, the power required to operate electrically-driven machines, street lighting with 32 and 50-cp incandescent lamps, and the effects of different shapes of e.m.f. curves of commercial apparatus. The Year Book contains an exceptionately clear physical and mathematical discussion of the electrostatic capacity of wires, by George D. Shepardson, professor of electrical engineering.

The Largest Generating Unit at the World's Fair.

Centrally located in the middle bay of the Palace of Machinery at St. Louis stand the 5,000-hp Allis-Chalmers engine and the Bullock generator. This great unit was installed not only as an exhibit but as already noted plays an important part in furnishing power for the decorative lighting and for the street railway lines leading to the Exposition grounds. During the daytime, from 2 o'clock in the afternoon until 7 in the evening, this engine and generator supply current to the St. Louis Transit Company for operating street cars from St. Louis to the Fair. This load is about 3,000 hp. The engine is frequently called upon for other work, such as furnishing current for operating the pumps supplying the Cascades, or for supplying power for the many purposes about the Fair.

In the evening the task of this unit is even greater, as it carries the current for nearly 200,000 8-cp incandescent lamps. This myriad of lights marking every architectural outline of the picture becomes visible as the dim glow of red gradually appears. Slowly this grows brighter until the whole picture is drawn in lines and accents of fire and then as the voltage is increased the lamps gradually become fully incandescent. A visit to the big unit will show how this is accomplished. At one corner of the exhibit stands a square cage filled with gridiron shaped pieces of metal. This is a rheostat, the purpose of which is to absorb the current created by the exciter for the generator of the big engine and regulate it until wanted. On its face is an arm which revolves a large number of contacts. As this makes a turn it cuts out, bit by bit, the resistance of the rheostat. On top of the cage is a little electric motor which, by means of a chain belt, turns the arm of the rheostat. When the time for lighting arrives an operator at the main switchboard touches a button and the little motor begins to move. As the resistance of the rheostat is gradually cut out the whole number of the decorative lights over the entire Fair begin to glow feebly, but all alike, and then to gain in volume of light, all in accord, as the arm progresses about its circle. One may see the entire operation by standing beside the rheostat at dusk.

The engine is of the style designed by the Allis-Chalmers Company for the Manhattan power station in New York City, where the current for operating the trains of the elevated railroad is produced. The low-pressure cylinder of the Louisiana Purchase Exposition engine is six inches larger than those of the Manhattan installation, thus constituting it the largest single engine of its kind ever made, and by far the largest ever shown at a World's Fair. It is capable, when worked to its full capacity, of producing 8,000 hp. The engine is a combined vertical and horizontal, compounded and condensing, running at 75 r.p.m., steam pressure 150 pounds, and the height of

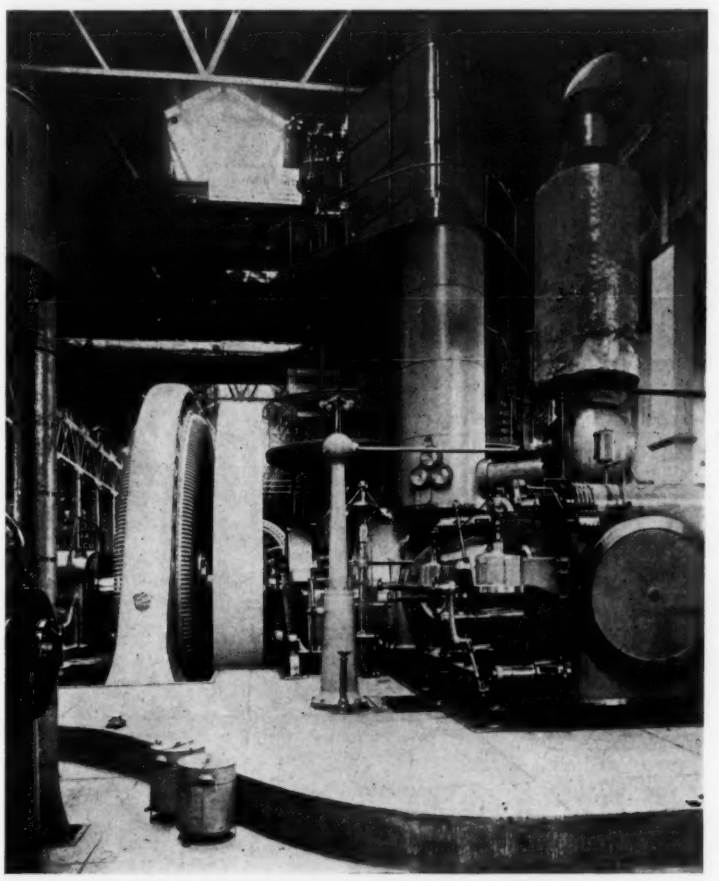


FIG. 2.—LARGEST GENERATING UNIT, ST. LOUIS EXPOSITION.

the engine above the foundation is 39 ft. 2 in. Other details are: High-pressure cylinder, horizontal; valves in cylinder; valves and cylinder double-ported; diameter, 44 in.; low-pressure cylinder, ver-

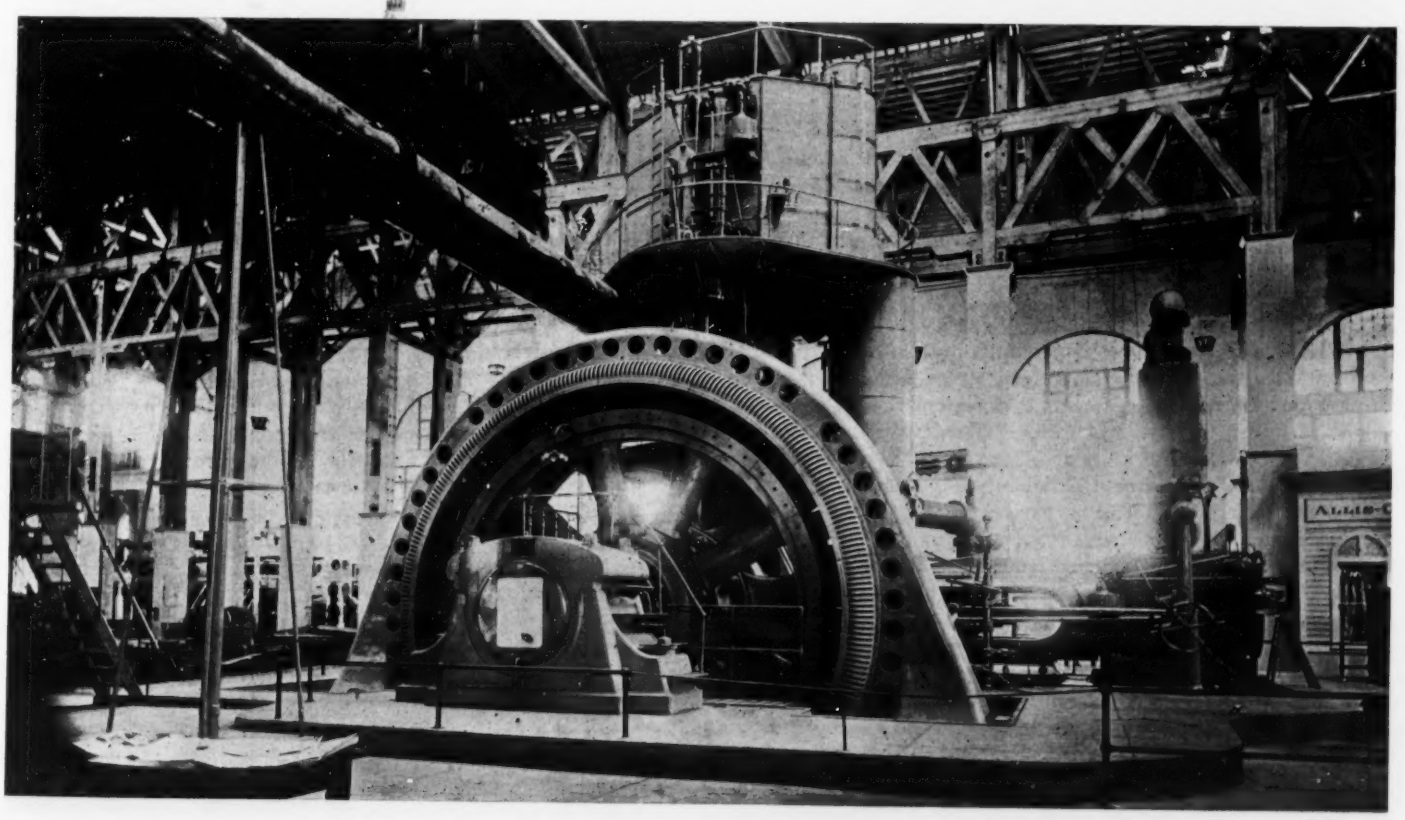


FIG. 1.—ALLIS-CHALMERS-BULLOCK GENERATING UNIT, ST. LOUIS EXPOSITION.

tical; side-pipe construction; valves in heads; valves double-ported; heads single-ported; diameter, 94 in.; piston rods, high-pressure, 9 in. in diameter; low-pressure, 10 in. in diameter; steam ports, high-pressure, area 150 sq. in.; low-pressure, area 712 sq. in.; exhaust ports, high-pressure, area 206 sq. in.; low-pressure area, 930 sq. in.; stroke, 60 in.; shaft hollow, forged open-hearth steel; diameter, 37 in. in wheel and generator fits, 34 in. in main bearing; crank pin nickel steel, 20 in. diameter 18 in. long, common to both high and low-pressure engines; fly-wheel, 25 ft. in diameter; rim, 30 in. face, 33 in. deep; built in 10 segments, weight 300,000 pounds. The whole engine weighs 720 tons, while the revolving parts, including the rotor, weigh 514,400 pounds. The condenser is of the Alberger barometric type.

The regulator of the engine is of the center-weighted, fly-wheel type, and actuates the cut-off cam of both high and low-pressure cylinders. Mounted on the regulator cross-shaft is a device for changing the cut-off on the low-pressure cylinder by hand, independent of that of the high-pressure. It is also possible to vary the ratio of cut-off between the two cylinders by means of a hand-wheel adjustment on the arm transmitting the motion of the regulator to the low-pressure cam. By these arrangements it is possible to maintain a proper receiver pressure under all possible conditions that may arise in the operation of a large power unit.

The speed of the engine can be increased or decreased several revolutions per minute. This is accomplished by an adjustable weight mounted in a yoke on the regulator cross-shaft. By moving this weight in either direction from its central position, which is neutral, the effect is equivalent to increasing or decreasing the center-weight of the regulator. An electric synchronizing device is attached, to be used while operating the generator in multiple with others. A small, reversible electric motor is mounted upon the regulator column in a manner similar to the hand speed-changing device previously described. This motor is operated from the main switchboard by means of a double-throw switch. The motor itself forms the weight for varying the speed, and is made to travel in a frame by means of gears and a threaded spindle.

When it is desired to get the generator "in step" with others in operation, the switchboard operator can instantly bring the machine to synchronism by means of the switch-controlling motor on the regulator. An ingenious but simple arrangement is provided to prevent damage to the motor or its attachments, if at any time it should be allowed to run to either extreme of its travel. The gear turning on the threaded spindle, previously described, engages the latter through a clutch, causing the spindle and gear to revolve together, thus preventing the motor from advancing in its mounting, though it may still continue to run. This obviates the use of cut-out switches on the motor, and the only interruption in the motor circuit is the switch on the main board. The regulator is equipped with a belt-rider safety stop. This acts on the high-pressure cut-off cams and prevents the steam valve from opening. An oil dash-pot is attached to the column of the regulator, to prevent "hunting" effects while the engine is operating under variable loads. The piston of this dash-pot is turned spherically on its face, thus obviating the possibility of bending action between it and the bore of the pot.

The 3,500-kw Bullock alternating-current generator, like the engine, is capable of carrying a steady 50 per cent. overload and of withstanding without harm much greater loads for short periods. The generator produces a three-phase, 25-cycle current of 6,600 volts, running at 75 r.p.m. This generator has attained a regulation within 6 per cent., and is in several other respects remarkable. The engine can be regulated within 2 per cent., making, it is said, with the generator, a steam-electric unit without a rival in this respect. Before the opening of the Fair it was tested and accepted by the Exposition officials without a change having to be made. The generator was built by the Bullock Electric Manufacturing Company, of Cincinnati, Ohio. The generator, in common with all other alternating-current generators of the Bullock make, is of the revolving-field type. This construction provides, among other advantages, easy access to the armature and gives ample room for insulation for the armature coils. It also protects the armature coils from disturbance or distortion through mechanical strains. The armature yoke, which measures 35 ft. over all, has an opening 27 ft. in diameter. It weighs 58,000 pounds and is cast in four pieces. These sections are securely joined by means of square splines and body-bound bolts. The bolts are all on the inside of the yoke and there are no lugs or other projections outside to mar the graceful lines of the stator. The castings are so cored as to provide for the admission of an abundance of air for ventilating the armature coils. The circulation of air is made sure through the centrifugal effect of the rotor when the machine is in operation.

The stator core is built of discs of mild annealed steel, each being 14 mils in thickness. The discs are annealed a second time after punching and then to reduce eddy currents are each carefully coated with japan. Great care was taken in making the punchings. The discs and punches are constructed with the perfection of the most modern methods and so perfectly that they make no burrs on the punchings. This eliminates the necessity for filing the slots and greatly reduces the iron losses. The punchings as assembled are separated at frequent intervals by brass castings in such a manner as to produce wide air ducts for ventilation and the mass is held rigidly together by bolts.

The rotor has ten cast-iron arms secured between heavy cast-iron flanges bolted together. The tops of these arms are built up with 1/16-in. steel punchings, forming a core. The core is ventilated by means of brass spacers each ¼ in. wide, and is dove-tailed to receive the pole pieces, of which there are 40. Each is secured to the core by wedge-shaped steel keys. The pole pieces are built up of laminated annealed steel plates. These plates are held together between malleable-iron end pieces and secured by rivets. The magnetizing coils of the fields are formed of copper strip wound on edge. This method of winding insures the rapid dissipation of heat from the field windings and permits with safety the use of peripheral speeds as high as are possible with wheels without windings. With the ordinary method of winding the heat developed in the inner coils has to find its way to the surface through a succession of wires and insulation, the latter offering great resistance to its passage. With the strip windings the course of the heat developed next the fields is through the copper, and it is easily dissipated. The collector rings are of copper and are 51 in. in diameter. They have liberally proportioned brush surfaces and are widely separated by air spaces to insure insulation. The brush holders are of the box construction designed by the Bullock Company. Carbon brushes are used. Curve sheets of tests show the following efficiencies for this style of generator at various loads: One-fourth load, 90.3 per cent. efficiency; one-half, 94.6 per cent.; three-fourths, 95 per cent.; full, 96.7 per cent.; one and one-fourth, 97 per cent.; one and one-half, 97.1 per cent.

The generator which furnishes exciting current for the 3,500-kw unit is of 200-kw capacity and direct-connected to a 300-hp Ideal engine, running at a speed of 200 r.p.m., and generates 833 amp. of current at 250 volts. Only a portion of this current is needed to excite the poles of the large dynamo. The remainder of the current is used for charging the storage batteries of the electric launches on the lagoon and for power to operate machine tools in the Niles-Bement-Pond exhibit. The first feature about the generator which attracts the observer's attention is a brush-oscillating device. The brushes are carried in the usual ring rigging, and this sets in what at first glance appear to be the usual grooved bearing wheels. Closer observation, however, reveals the fact that when the exciter is in operation these wheels are slowly revolved through the medium of a belted gear and oscillating clutches, and as they make a revolution they are forced along their axles by a cam until they have moved about half an inch. When the end of the cam is reached, it lets go, and springs return the wheels to their former places. This process is continually repeated as the generator runs. Its result is to prevent the brushes from wearing grooves in the commutator and to keep both brushes and commutator smooth and to free them from dust and dirt. It has also been found that the oscillating action of the brushes will wear down and remove causes of trouble from any part of the commutator. This eliminates several ordinary causes of sparking. Other causes for sparking and loss of efficiency have been removed by the engineering skill of the designers in securing just the right proportions of iron and copper in the make-up of the generator. These proportions can only be arrived at by experience. No shifting of the brushes is required through the whole ordinary range of load from zero to a 50 per cent. overload. The armature conductors are large, and in fact wherever liberal proportions are of advantage they have been provided. The stator yoke is built of cast iron, which is more homogeneous than steel and also admits of making the yoke wide enough to thoroughly protect the pole pieces. The pole pieces are laminated and are bolted on.

Electricity and the New Steamer Wolvin.

BY WALDON FAWCETT.

THE new steel steamer *A. W. Wolvin* (Fig. 1), the largest vessel ever constructed on the Great Lakes, is possessed of several elements of interest for the electrical world. For one thing, the *Wolvin* was built at the Lorain (Ohio) plant of the American Ship Building Company, an institution where electricity is employed more extensively in the construction of steel vessels than anywhere else on the Great Lakes, and all the steel plates and other heavy material used in the construction of this vessel were handled by two unique electrically-operated gantry cranes, Figs. 2 and 3, designed by Mr. Alexander Brown, the well-known American engineer.

FIG. 1.—LARGEST LAKE STEAMER, "WOLVIN."

The two cranes are duplicates in every respect. Each crane is operated upon three longitudinal tracks, comprising two runways upon which the entire crane travels. Two of the tracks, or rather rails, are mounted on a trestle on one side of the ship's berth, while the third rail is mounted upon a trestle on the opposite side of the ship's berth. The mechanism for traveling, hoisting and trolleying is in the house carried on the pier of the double-track end of the crane.

The clear span of the structure between supports is 58½ ft. and the cantilever extension is 14 ft., making the total length of the bridge tramway on which the trolley travels 72½ ft. The working capacity of this crane is 14,000 pounds and it will hoist this load at the rate of 30 ft. per minute and will travel the trolley across the bridge with full load at 250 ft. per minute, while the whole structure with full load can be traveled along the tracks at from 300 to 400 ft. per minute.

A single electric motor is used for each crane, operating through friction clutches. The operating levers are arranged in the upper part of the house and so located that one operator can control the different motions at one time if desired. The crane is so arranged

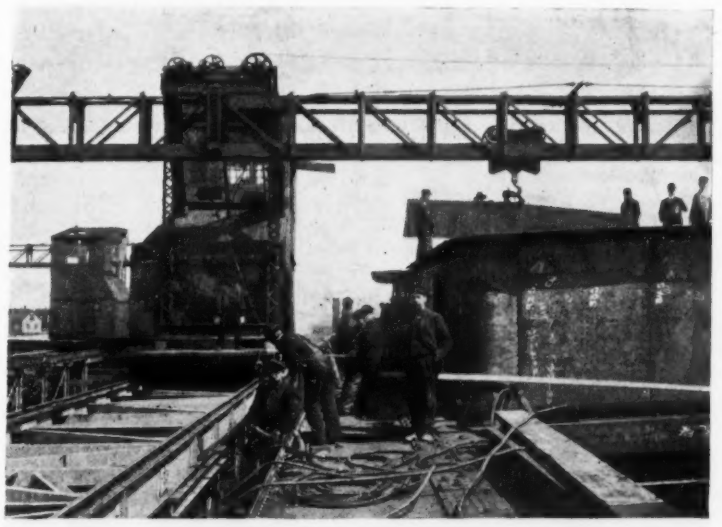


FIG. 2.—ELECTRIC CRANE USED IN BUILDING "WOLVIN."

that the span can be reduced by units of 2 ft. by disconnecting the single pier and moving it, together with the supporting track, 2 ft. nearer to the double pier. This was particularly advantageous in the case of the *Wolvin*, which had to be launched sideways, and in which case the outer trestle was in the form of a scaffold and was removed entirely when the hull was completed and ready for launching.

It is the universal practice to install electrical plants for lighting the great cargo-carrying vessels on the Great Lakes, but the *Wolvin* has two General Electric generating sets of 15 kw for lighting purposes, the idea being to hold one set in reserve for use in an emergency, thus guarding against any accident to the machinery, which would leave the ship in temporary darkness—always a serious danger—should it occur in one of the narrow and usually crowded channels connecting the Great Lakes.

The new queen of the fresh water fleet is 560 ft. in length over all, 540 ft. length of keel, 58 ft. beam molded at the widest part, and 32 ft. molded depth amidships. The engines are of the quadruple, four-crank type, with cylinders 18½, 28½, 43½ and 66 in. diameter and 42 in. stroke of piston, and are designed for an indicated horsepower of 2,000 when making 80 r.p.m. Steam is supplied from two Babcock & Wilcox boilers working at a pressure of 250 pounds.

Aside from being the largest vessel ever built on the Great Lakes, the *Wolvin* enjoys another distinction, that of being the first vessel designed especially to facilitate unloading wholly by mechanical means, through the medium of the automatic unloaders equipped with "clamshell" buckets. To facilitate the operation of these machines the cargo hold is built in hopper form, 43 ft. wide at the top and only 24 ft. in width at the bottom. To enable the grab buckets to reach every part of the hold and do away entirely with hand shoveling, the deck is pierced by thirty-three hatchways which are fitted with sliding steel covers, mechanically operated.

St. Louis Exposition Electricity Club.

The exhibitors and their representatives in the Palace of Electricity at the St. Louis Exposition have formed an organization known as the "Exposition Electricity Club," its object being largely social and to represent the exhibitors on formal occasions. The membership is open to electrical exhibitors and their representatives, the members of the Electricity Department and others connected with the Exposition associated with electrical industries. A well-furnished club room has been provided in the office gallery for the use of the club. The officers for the term of the Exposition are as follows: President, Frank H. Gale, General Electric Company; first vice-president, W. K. Dunlop, Westinghouse Companies; second vice-president, H. W. Pope, American Telephone & Telegraph Company; third vice-president, J. W. Dunfield, Allis-Chalmers-Bullock Company; secretary, Edward Dixon, British Electrical Section; treasurer, F. V. L. Turner, Kellogg Switchboard & Supply Company. The Executive Committee consists of the officers and the following: W. A. Layman, Wagner Electric Company; J. S. Hamlin, National Electric Company; Cloyd Marshall, Department of Electricity; C. B. Fairchild, Jr., *Street Railway Review;* C. P. Frey, Weston Electrical Instrument Company. The club started with a membership of nearly 100, which is constantly increasing.

It is proposed to make the meetings social gatherings, at which the exhibitors at the Exposition can become better acquainted and discuss matters of mutual interest; also, it is planned to invite prominent electrical engineers to give informal talks from time to time. All electrical men who may be visiting the Fair will be made welcome. Dr. Lee De Forest has given a lecture upon "Wireless Telegraphy" and Prof. J. C. Kelsey one upon "Wireless Telephony." On "Transportation Day," July 30, the club marched from the Electrical Building to the Transportation Building and was there received by the officers and exhibitors of that building. About 250 were in the line of march.

Quarterly Report on Electrical Fires.

The electrical bureau of the National Board of Fire Underwriters has issued its quarterly report on electrical fires, in which it gives the following summary as to causes:

"Twenty crosses of telephone, telegraph and other signaling circuits, with lighting and power circuits, have been reported. Twelve fires have been caused by dynamos and motors, in eight cases due to burning out of armature or field coils. Twenty-seven cases of the grounding of circuits are reported, of which twelve were on awnings and metal work of buildings. Five fires have been caused by short-circuit in flexible cord, due principally to the use of defective 'commercial' cord with thin rubber insulation, and to the wrapping of the cord around pipes, nails, etc., which injure the insulation. Six fires are reported due to short-circuit of wires in fixtures. Four fires were occasioned by short-circuit in wattmeters, one of the devices being an old-style chemical meter. Four fires were due to the use of open-link fuses, principally in the defective porcelain cut-out blocks. Five fires were caused by the heat from incandescent lamps located near inflammable material. Twelve reports of damage by lightning have been received. In at least four of these fires the

lightning entered the building over the lighting or signal wires, which were not protected with reliable protective devices. Six fires have occurred in electric cars.

"Reports of 145 electrical fires, losses aggregating over $172,000, have been received during the last quarter. Reports have been received of 107 fires, losses aggregating $13,611,900, supposed to have been due to electricity, but they are not included in this report, as the causes could not be definitely proven as electrical, principally because the fires destroyed the conclusive evidences of their origins. One of these fires occasioned a loss reported about $12,000,000. Twenty-nine fires, losses aggregating $250,407, reported as due to electricity, have, upon further and more reliable investigation, been found to have been due to other causes."

CURRENT NEWS AND NOTES.

RAILROAD TELEPHONY.—It is stated that the Pennsylvania Railroad will use the telephone on its block system on the new West Pennsylvania instead of the telegraph.

TO THE POLE BY WIRELESS.—The French savant, M. Bénard, is convinced that Nansen took the only route by which the North Pole can be possibly reached. He favors an expedition with two ships connected by wireless telegraphy. The time is estimated at three years, and it is hoped that the Prince of Monaco, who is greatly interested, will contribute the necessary $300,000.

EMANIUM.—A strongly radio-active earth consisting chiefly of lanthanum has been obtained from pitchblende by Giesel, a German chemist. According to the *American Journal of Science:* "He finds that the behavior of the material is different from that of radium, and believes that he has obtained a new element which he calls emanium, and which he hopes to separate from lanthanum. The striking characteristic of this material appears to be an emanation given off by it. When air is blown through a flask containing preparations of the substance enclosed in paper capsules, and the air issues from a tube against a blende screen, a brilliant illumination is produced, and scintillations can be observed even with the naked eye. The 'sparks' are more distinct and larger than those produced by radium or polonium, and hence the material is more effective than these for use in the spinthariscope."

WIRELESS IN CANADA.—The contract between the Canadian Government and the Marconi Wireless Company calls for the installation of seven stations in Canada, all of which must be completed and in operation prior to July 1, 1905. Since this agreement was signed the Marconi Company has had a special body of workmen at work on the contract. The seven stations are to be constructed at Fame Point, Heath Point, Port Amour, Belle Isle, Cape Race, Sable Point and one station on the main land. Already the two stations at Fame Point and Heath Point are completed and in operation, and have now demonstrated themselves to be of commercial value. The Allan Line steamers, which are now equipped with the Marconi system, are receiving and sending messages from these stations.

RAPID TELEGRAPHIC TRANSMISSION.—A patent granted August 2 to Mr. Francis W. Jones, electrical engineer of the Postal Telegraph Company, relates to a system whereby use can be made of the skill, intelligence and experience of the Morse operator in transmitting and recording (such operators having a mental and manual dexterity or speed of something less than forty words per minute), while economizing the time of use of the line by employing an automatic double current or machine transmitter operating at a speed of about 3,000 words per minute. A skilled Morse operator is employed to transmit with a Morse key and his work is recorded, stored or accumulated in the form of a prepared paper strip. A double-current machine transmitter at one line terminal and a polarized recorder at the other line terminal, respectively, transmit and reproduce this strip. At the receiving end of the line the received strip is passed through a local circuit operating an ordinary Morse sounder at a speed within the mental and manual capacity of a skilled Morse operator, who records it with a pen or typewriter in the ordinary well-known manner. By this method of operation and arrangement of apparatus the message is transmitted by the use of an ordinary Morse key at, say, thirty words per minute, passed over the line by positive and negative currents at the rate of about 3,000 words per minute, and recorded at the receiving end by a skilled Morse operator at the rate of, say, thirty words per minute, ready for immediate delivery.

STARTING DEVICES FOR VAPOR LAMPS.—The great success of the ordinary incandescent lamp is due to the extreme simplicity of its action. When the current is turned on, Joulean heat is developed in the filament and the lamp is lighted practically instantaneously. With all other types of electric lamps some starting device is needed. The arc lamp is started by bringing the carbons into contact and some regulating device is necessary to keep them at proper distance afterward. The filament of the Nernst lamp is a non-conductor at ordinary temperature and must, therefore, be preheated. Mercury and other vapor lamps need a higher voltage for starting than afterward. In some types of these latter lamps a special source of high potential is, therefore, provided for starting which is afterward cut out of the circuit. Another method which seems more practical might be compared with the method of starting an arc lamp by bringing the two carbons into contact. Three patents relating to this subject were recently granted to Mr. S. E. Flichtner, of the Cooper Hewitt Electric Company. This method consists essentially in tilting the lamp so that a portion of the mercury in the receptacle containing the lower electrode will be spilled into the receptacle for the upper electrode, and the excess will then be restored to the lower electrode receptacle in a stream, while the current is applied to the terminals. This method is especially adapted to initiating the operation of two or more gas or vapor devices in series. Two of Mr. Flichtner's patents refer to this method and for the apparatus required for it, while a third patent relates to means whereby, through the operation of a similar starting process, two or more vapor lamps can be started and run independently or in series at will, the extra voltage being taken up in resistances or incandescent lamps.

THE STUDY OF NATURE.—In his commencement address at the Worcester Polytechnic Institute, President Remsen, of Johns Hopkins University, offers a comparatively new reason for the rapid progress recently made in the understanding of natural phenomena. His chief explanation is that men have learned to rely less on the imagination than formerly and more on patient, persistent work, even though it involves disagreeable manual labor. Speculation may afford useful clews, but unless these are followed up it is impossible to tell whether they lead to truth or error. Discussing the address, the New York *Tribune* remarks: "President Remsen is, of course, too well informed and too sensible to affirm that all inquiries which have been undertaken with the latter motive have yielded practical results, but he is inclined to believe that the majority of investigations which did so had their origin in a simple thirst for knowledge. To illustrate his idea he refers to the beginnings of electricity. It had been noticed that if a piece of amber was rubbed it would attract a bit of pith. If the leg of a dead frog were touched with a piece of metal it would wriggle. Could any phenomena be more trivial? Did not the efforts of Volta and Galvani to explain such things seem positively childish? Again, consider the principal puzzle which fascinated Faraday. A way had been found to convert electricity into magnetism. Might it not also be feasible to obtain electricity from a magnet? The problem was solved only after years of experiment, and without the silghtest notion of what might be done with the product, should the search prove successful. It was the intellectual passion of the philosopher alone that urged him forward. To-day millions of capital are invested in electric light and railway systems made possible by the dynamo, the theory of which was supplied by Faraday, but he was seeking no such practical result."

TRAIN ORDERS BY TELEPHONE.—As the result of a strike of telegraph operators on the Missouri, Kansas & Texas Railway, the management resorted to telephones for train dispatching and claims to have maintained the schedule in this way.

INTERNATIONAL RAILWAY CONGRESS.—A preliminary pamphlet has been issued by the American Railway Association, of which Mr. L. F. Loree is president, in regard to the International Railway Congress, whose last session was held in Paris in September, 1900, and whose next is to be held in Washington in May, 1905. Electrical traction is one of the topics specially named and is to be reported on by Mr. W. D. Young, electrical engineer of the Baltimore & Ohio Railroad; Mr. Paul Dubois, engineer of the Orleans Railroad, of France; Mr. Ernest Gerard, of the Belgian Railway Service, and Mr. Victor Tremontani, chief inspector of the electrical section of the Mediterranean Railway, of Italy. Suburban traffic is also taken up, as well as train lighting, automatic block systems and signals, light railways, track for fast trains and other important branches of the industry.

TELEPHONOGRAM.—An apparatus for recording and reproducing sound, as patented by Christian Hulsmeyer August 2, 1904, differs from the well-known Edison phonograph in that the sound is recorded by the effect of light rays upon a sensitive film and is reproduced by passing the film between a source of light and a selenium cell included in a receiver circuit of a telephone. Light from a suitable source is caused to strike upon a mirror and be reflected through a plate whose transparency varies in the direction of motion of the rays, and to fall upon a uniformly moving sensitive strip. The position of the mirror is determined by the attractive force of an electromagnet in the transmitter circuit of a telephone, so that when sound waves strike the microphone the mirror moves to and fro, and the light which falls upon the film correspondingly varies in intensity, due to the varying transparency of the plate through which it must pass.

ENERGY STORING DEVICE.—To provide means for increasing the efficiency of electric railway systems by utilizing, in part at least, the energy which ordinarily is wasted in the starting resistance, is the object of a patent issued to F. E. Case August 2, 1904. The inventor substitutes for a portion of the starting resistance used with railway motors a device which consumes the energy ordinarily absorbed in the resistance and stores it for operating the brakes. The storing device may take the form of a motor-driven air compressor with receiving tank, or an electromagnet acting against a powerful spring which tends at all times to set the brakes. With the latter equipment is included means for retaining the brake shoes in their retracted position, this being under the control of the motorman and consisting of a retaining wedge sliding between two guides, which are held in position by means of worm gearing automatically drawn together by a spring or separated by a lever operated by the motorman.

DUST GUARDS FOR ROTARIES.—Designers of electrical machinery have always been guided in improving upon early types of apparatus by the experience which their products have undergone in practice. This is particularly true in the case of rotary converters, which have been brought to a high state of reliability, efficiency, freedom from sparking and hunting by a decade of operation in sub and generating stations. The electrical difficulties have been taken pretty well in hand by the engineers of the manufacturing companies. The recent experience of a Western street railway company, according to the *Street Railway Journal*, however, shows that more consideration should be given to the old problem of mechanical friction. A 500-kw machine installed in a sub-station of the road in question gathered dust enough to require its bearings to be scraped four times in the past four months, so badly were the wearing surfaces cut by dust and grit which lodged in the journals. The sub-station was located between a large building and an open yard, and the shaft of the machine affected was in direct line with the windows and door. The remedy of the railway company was the simple expedient of tying cloths over the end of the shaft, but the difficulty is certainly serious enough to warrant the provision by the designers of some permanent dust guard which will eliminate the necessity of fitting up machines with the night-cap affair born of the present emergency.

LETTER TO THE EDITORS.

The Phenomena of Lightning Flashes in Hail.

To the Editors of Electrical World and Engineer:

SIRS:—For a number of years I have been interested in, to me, an apparent connection between the phenomena of lightning flashes and hail. My reason for believing in such a relationship has been the simple but, I think, the strong one of fact, that the production of electric energy on a large scale is so often concurrent with the extremely rapid absorption of heat energy. This coincidence can hardly be an accident, but is rather direct evidence of the physical connection which has been noted. Quite recently a hypothesis covering and explaining the phenomenon has presented itself to me, and I am taking the liberty of offering it for the consideration of those interested in the subject.

It is well known that heat is merely a name for molecular motion, "temperature" being the equivalent of a function (the square) of the molecular velocity. In order that the transference of heat energy into electrical energy may be easily grasped by those unfamiliar with the laws governing such a transfer, we will consider a parallel case, such as the hot air or compressed air motor.

Consider a single molecule of air to be imprisoned between a fixed cylinder of an air motor and the piston. If the molecule is "hot," i. e., if it has any temperature higher than absolute zero, it will travel in various directions at a high rate of speed. When it reaches the cylinder head or walls it will simply change its direction of motion, i. e., it will not change its heat energy. The same thing will happen when it strikes the piston, provided the latter does not move. If it be free to move, however, it will do so when the molecule strikes it. The rebound of the molecule will be at a lower speed, therefore, than if the piston had remained stationary, and its heat energy will be reduced, having been transferred to the piston, and transformed from heat or molecular energy into mechanical or mass energy.

Turning now to the heat electrical transformation, let us suppose two molecules, one of air and the other of water vapor, to be moving relatively toward each other at a high speed. These molecules are, in virtue of their motion, "hot." If they were to strike each other and rebound at the same relative speed as before contact, they would not lose any of their heat energy. If, on the other hand, the act of contact between them were to set up a positive charge in one and a negative charge in the other, something different would occur. At the moment after contact the speed of the rebound would be the same as that just before contact, and while the electrical charge would exist, there would be no electrical *energy* because the distance between the charges is nil. From the moment after contact the two charges on the two molecules, being of opposite sign, would attract each other, and the speed of the molecules would decrease in response to this attraction, i. e., the heat energy of the molecules would continuously decrease. At the same time the potential of the two charges would rise on account of the continuous lowering of the inductive capacity between them, and the result would be the production of electric energy. The extraction of heat would mean the production of cold and the more or less rapid condensation of the surrounding cloud vapor, or possibly its freezing—in other words, rain or hail. This seems to explain the violent dashes of rain during thunder showers, which it is difficult to understand on other grounds, as there seems to be no other cause competent to extract heat and so produce condensation at such a rapid rate as is frequently noticed. As a heavy deluge of rain and heavy lightning flashes would be caused by the same agency, and might take an entirely different period of time to come into apparent action, there would seem to be no reason to assume, as we remember one authority to have done, that the flash is produced by the shower because there appeared in certain instances to be a very short but pronounced interval between the two. In a storm which occurred a few days ago, heavy chain lightning, i. e., the real thing, played about in a sky having only a slight haze, while the storm clouds were over a mile away. This illustrates the independence of downpours and lightning flashes, though not proving, of course, that the latter are not sometimes precipitated by the former. The condensation explanation of the identity of the causes of flashes and downpours appears, however, to rest secure on its own basis of superior probability as compared to the explanation noticed above that one is the cause of the other.

We have outlined a complete system covering the transformation of heat energy into electric energy, and I thoroughly believe that some such action must take place. It is certain that the electric energy is not created from nothing.

As a corollary to the above, it may be noted as a possibility that when the heat speed of the molecules is below a certain limit, as in winter, the electric charges upon them may be sufficiently strong in proportion to their original momentum to prevent them from leaving the sphere of each other's action. In this case, while the potential might become high, it would not be possible for the molecules of the same polarity to become segregated, and as a consequence there would be no lightning flashes on a noticeable scale—a result certainly noticed as existing in cold weather, as your readers are aware.

Probably the greatest need of the future is the extension of the sphere of electricity from a mere transmitter of power to a prime-mover on a commercial scale; and it seems to be the true Baconian method and a very interesting one indeed, to carefully collect and survey any cases in nature in which electric energy may be generated directly from a universal energy supply such as chemical action or heat, particularly the latter, and also to consider the ways and means by which this result is accomplished. It is quite interesting to note that the transformation of energy in this case occurs in a medium of uniform temperature.

BROOKLYN, N. Y. IRVING A. TAYLOR.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Single-Phase Motor with Large Starting Torque.—COLLISCHON.—An illustrated description of a single-phase motor built by the Lahmeyer Company and stated to have been successfully used in elevators with a frequency of 100 periods per second. It is essentially a combination of a repulsion motor and an induction motor. The primary windings are of the ordinary kind used in induction motors, while the secondary rotor is provided with a direct-current winding and a commutator. The rotor winding has connections not only with the commutator, but also with three slip rings which are connected to three points of the armature winding, displaced from each other by 120° The brushes which slide on the commutator are short-circuited, while the slip-ring brushes are connected to an induction motor-starter. If this starter remains open, the motor will show the characteristic behavior of a repulsion motor, indicated by curve II in Fig. 1 (maximum torque at standstill). If, however, the motor

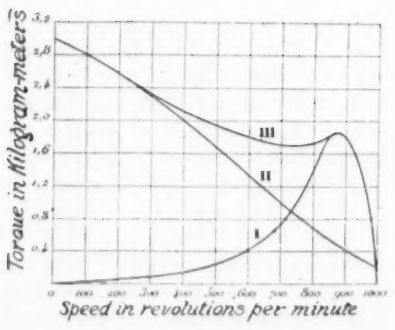


FIG. 1.

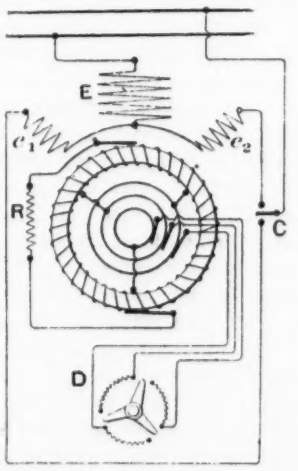


FIG. 2.

runs at full speed as a pure induction motor, i. e., with short-circuited slip rings, its characteristic curve is as indicated by curve I (maximum torque near synchronism). If the motor is started as repulsion motor and the starter is gradually switches in, the characteristic curve will correspond to curve III, which is the sum of I and II, with a high and fairly constant torque during the period of starting. To reverse the direction of rotation the device shown in Fig. 2 is used. Besides the main winding, F, two auxiliary windings, f_1 and f_2, are provided, each of which may be connected in series with F to the network by means of the switch, S. These auxiliary windings are displaced with respect to the principal winding in such a way that the field can be displaced by 20° in the one or the other direction, with respect to the magnetic axis of the main winding. By this displacement of the field with respect to the short-circuited collector brushes, the direction of the rotation of the motor can be reversed.—*Elek. Rundshau*, June 1; *L'Ind. Electrique*, July 10.

REFERENCE.

Single-Phase Motor.—GOLDSCHMIDT.—An illustrated communication pointing out in which respects his single-phase motor, built by Crompton & Co., differs from the original repulsion motor of Elihu Thomson. He also replies to some criticisms by Schüler.—Lond. *Elec.*, July 15.

LIGHTS AND LIGHTING.

Nernst Lamp.—SALOMON.—A paper read before the German Assoc. of Elec. Eng. on new commercial forms of Nernst lamps made by the Allgem. Elek. Ges. Being a source of light, of a medium intensity between the arc lamp and the incandescent lamp, the Nernst lamp is specially useful for street lighting as a substitute for incandescent gas lighting. The application of Nernst lamps has been somewhat restricted so far, since only medium light intensities could be obtained. Experiments to make lamps for higher currents than 1 amp. have not given very satisfactory results. The multiple filament lamps in which three filaments are combined in one globe enables one to get lighting intensities up to 750 candles. In many cases the multiple-filament lamp is a satisfactory substitute for the arc lamp, especially where it is difficult or inconvenient to replace the carbons. The fact that it takes a little time to light a Nernst lamp has sometimes been considered as a disadvantage. The company made experiments to construct the heating wire in such a way that it may be used itself as lighting filament as soon as the circuit is closed. Experiments made in this direction have given results pointing toward success in the end. In the meanwhile they use in some forms of their lamps ordinary incandescent lamps in series with the heating wire. As soon as the circuit is closed, these ordinary incandescent lamps are lighted; they are disconnected together with the heating wire as soon as the Nernst filament is lighted. Another advantage of this combination is that the ordinary incandescent lamps are useful as a reserve.—*Elek. Zeit.*, July 21.

Lighting of Railway Cars.—A note on experiments made by Staby on the Bavarian railways concerning the power required to generate the electric current for lighting railway cars by the Stone system. Trials were made with an ordinary railway car fitted on this system and hauled by an accumulator car of standard gauge, the current being measured by specially calibrated instruments interposed between the accumulator and the motors. The trial runs were made on days when there was no wind, at intervals of one hour and the instruments were read when passing the railway kilometer posts. The lighting dynamo of the hauled carriage was adjusted by tightening the belt so that its output at 24.9 miles per hour amounted to 35 amp. The car was provided with 14 incandescent lamps of 12 cp and two of 8 cp, so that the total lighting was of 184 normal cp, which, assuming the average normal cp to require 3.5 watts, required altogether 644 watts. The lamps, therefore, require 27 amp. at 24 volts, so that 8 amp. of the output of the dynamo were available for charging the batteries. The averages of the amounts of energy consumed on 18 trips, running at a speed of 28 miles per hour, were as follows: When the dynamo and the incandescent lamps of the hauled car are in use, 40.866 kw; when the driving belt was taken off the dynamo of the hauled car, 39.300 kw. The difference, therefore, was 1.566 kw. Tests at higher speeds were conducted on a stationary testing set, and it was observed that at a train speed of about 56 miles per hour the energy required to operate the generator for the same number of lamps amounted to 2.46 kw.—Lond. *Elec.*, July 15.

REFERENCE.

Theatre Lighting.—HECHT AND MIRAM.—Two communications on the electric lighting of theatres. Hecht deals especially with those arrangements which are necessary to insure safety. Stage and auditorium should receive current for lighting from a source of electrical energy which is always protected against fire, and which is also separated electrically during the performance from the battery used for lighting the exits, stairways, etc. He suggests that the exits should be lighted from the outside with strong lamps. Miram describes the system of distribution of the electric current in the theatre of Aachen.—*Elek. Zeit.*, July 14.

POWER.

Cost of Water Power Developments.—BELL.—An article pointing out that the first necessity in electrochemical works is an abundant and cheap supply of electrical energy and commercial success often depends on the cost of the energy. Broadly, it is best for electrochemical industries to own and operate their own generating plants. If energy is bought from a supply company good terms can be made especially in two cases. The first is where the electrical development, as at Niagara Falls, is on so enormous a scale that the market prices are in a measure controlled by a relatively moderate, although absolutely very great demand, and the size of the plant renders it easy to take care of even the severest demands. The second case is where the electrochemical demand for power is not necessarily continuous throughout a longer working day and where it is possible to buy electric energy between midnight and three or four p.m. of the next day only. The question of cost of electrical energy is different if the supply is made from a separate corporation or from a plant of one's own. The ruling prices for cheap electrical energy for motors range from $15 per hp-year up, for ten to twelve hours per day. Anything under a cent per kw-hour is very cheap power, even to large consumers. The author then discusses the cost of developing a water power. Concerning the distance, he says that up to 20 or 25 miles the total cost of transmission is not at all serious. Within moderate distances, the critical point of economy is the cost of developing the hydraulic power. It comprises the purchase of the hydraulic rights, from $5 to $25 per hp available throughout the year and the work of erection. The total is most uncertain, between $25 per hp to $100 or more. The hydraulic rights and development form together rather the larger half of the total cost of getting a power transmission under way. At the usual line loss of 5 to 10 per cent., the cost of the conducting wires can be kept down to $5 and the total line cost to below $10 per kw. The generators and transformers costs run from $15 to $25 per kw-capacity of plant. Summing up, he says that an electric power transmission plant from water, over a moderate distance, is likely to cost from $60 to $100 per kw-capacity delivered on the low-tension side of the reducing transformers. Against this must be charged suitable interest, depreciation and taxes, together with some general expense and the operating charges. The average hydro-electric transmission plant is likely to find its total expense about equally divided between fixed and general charges on one hand and operating expense on the other. The total is likely to amount to between 15 and 20 per cent. of the total cost of plant. The cost of power delivered in plants of the kind considered is likely to be between $10 to $20 per kw-year for 24-hour power.—*Electrochem. Ind.*, August.

Cost of Water Power Development.—A note stating that the cost of water power development in France, according to Prof. Janet, varies from $21.40 per hp to $150 per hp, depending on the head to be dealt with, the lowest expenditure being upon a fall of 140 meters in Haute-Savoie, the horse-power being calculated at the turbine shaft. At Geneva, for the first group of turbines erected, of 840 hp, and for the river works then completed, the capital cost amounted to $300 per effective hp. The groups of turbines subsequently erected cost but $95 per hp, and the completed works would cost but $135 per hp. At the chlorate works at Valorbe, the capital expenditure upon the development of 3,000 hp amounted to only $19.45 per hp.—*Jour. Franklin Inst.*, July.

REFERENCES.

Gas Engines.—MUNCH.—A brief but fully-illustrated article on the utilization of the waste gases from blast furnaces for driving gas engines coupled to electric generators. The caloric effect obtained from the gases by this means is 100 per cent. superior to that obtained if they are used for heating the boilers of steam engines. The author briefly points out the advantages of driving electric generators by gas engines for electric power distribution over that of using small gas engines directly for power purposes.—*L'Eclairage Elec.*, July 9.

Water Power in Mexico.—ROBERTS.—An article stating that several small hydro-electric power plants have recently been put into operation in Mexico, the power being mainly used in connection with textile and other factories as well as for lighting. At present there is one plant being actually installed which will develop 18,000 to 20,000 hp and another one in contemplation which will furnish 43,000 hp. Both of these are within 150 miles of the City of Mexico. Benefits which will accrue to the mining industries are pointed out, and an estimate is given of what could be accomplished by developing the power of the Necaxa River.—*Eng'ing & Mining Jour.*, July 21.

Superheated Steam.—BERNER.—An account of an extended experimental investigation in which the author considers the material required in the construction of steam superheaters, the transmission of heat through the surface of the superheaters, the velocity of steam through the superheater pipes and the work done by the boilers in the generation of th superheated steam.—*Power*, August.

TRACTION.

Electric Railway Statistics in Germany.—The very full annual statistical tables on electric railways in Germany, for the year ending October 1. The figures, given first in the following summary, relate to that date, while the figures in parentheses relate to October 1, 1902. The number of main centers of electric railways was 134 (125); the length of the lines (irrespective whether single-track or double-track) is 3,692 km. (3,388 km.); the length of rails 5,500 km. (5,151 km.); the number of motor cars 8,702 (8,365); the number of trailers 6,190 (5,954); the capacity of electric machines 1333,151 kw (120,776 kw); the capacity of storage batteries for traction stations 37,536 kw (30,052 kw). The trolley system is used nearly exclusively; only in Dresden a combined trolley and accumulator system is still used, while some lines in Berlin, Dresden and Düsseldorf are operated by the conduit system, and the third rail is employed on the Berlin-Gross Lichterfelde road and on the Berlin elevated and subway roads. The pure accumulator system is found only on the Palatian railways and on a line in Bremerhaven, but will soon disappear on both lines. Only 52 km. of street railways (i. e., about 2 per cent.) are still operated by horses. For main line electric traction some promising projects have been worked out. The Allgemeine Elek. Ges. intends to install electric railways between Leipzig and Merseburg and between Leipzig and Halle. Two projects for the electrification of the railway between Berlin and Hamburg have been worked out by the Siemens & Halske Company and by the Allgemeine Elek. Ges., respectively. The erection of an electric railway between Blankenese, Altona and Hamburg is certain. Some progress has been made on "trackless" trolley lines: the expense for power is much higher than for trolley traction on rails (about 125 kw-hours per ton-km., against 50 kw-hours), but in some cases where the cost of rail construction would be too high, the system is useful; six such lines are in operation. Since the first electric railway and the first practical electric locomotive were started on May 31, 1879, Siemens & Halske, in an exposition in Berlin, Germany, celebrates this year the 25th anniversary of the first introduction of electric traction.—*Elek. Zeit.*, July 21.

High-Speed Traction.—SIEMENS.—A long (British) Inst. Elec. Eng. paper giving the results obtained in the high-speed electric railway tests on the Marienfelde-Zossen line. The information given is based on the reports of the syndicate which made the experiments.—Lond. *Elec.*, June 10, 17, 24, July 8. In the discussion which followed the paper, Ferranti said that the experiments were of the highest possible interest, but "the one great thing that the paper brought home was that the conversion of existing railways in the manner adopted at Zossen was a matter of impossibility." Mordey thought that the three-phase system is not the one which can be used practically or is likely to be used for either high or low-speed electric railway working; the first essential of successful traction is simplicity. Siemens, in his reply, said that the object of the experiments was two-fold and was accomplished. First, it was shown that at very high speeds the energy can be transmitted through a conductor along the line to the car and a successful collector was developed for this purpose. The second thing was to find out what sort of a permanent way is needed. The shape of the car so as to diminish

resistance to wind has been carefully studied and the conclusion was reached that the paraboloid would be best, but this was precluded owing to the inconvenience which it would have caused to the driver; therefore, the center part of the paraboloid was developed into a cylinder.—Lond. *Elec.*, July 15.

REFERENCES.

Single-Phase Traction.—The Valtellina Railway in Northern Italy has been operated directly with three-phase, 3,000-volt, 15-cycle induction motors on the cars. It has now been decided to install for trial a Finzi single-phase equipment on one of the standard cars, to consist of four single-phase, 100-hp motors. This car will be expected to haul a 100-ton train at speeds up to 75 km. per hour.—*St. R'y Jour.*, July 30.

Surface-Contact System.—An illustrated article giving notes on the last design of the Kingsland mechanical surface-contact system. The car carries two strikers, one at the front and the other at the back. When running along the track, the former switches the current on to the stud by depressing a switch lever placed in a slot at the side of the track, while the striker at the back of the car switches the current off again, thus leaving the studs which have been passed "dead." A light skate is suspended from underneath the car to pick up the current from the studs.—Lond. *Elec.*, July 22.

Third-Rail Collector.—The sectional third-rail system of the Baltimore & Ohio belt line is operated by switches, and the pick-up current on the locomotive is derived from an electric air compressor, the compressor of which is driven as a motor, while the motor acts as a generator. A number of improvements which have recently been made in the compressor and governor are described.—*St. R'y Jour.*, —July 30.

Motor Cars.—An illustrated description of motor cars on European railways. Besides some steam motor cars and oil motor cars, an oil and electric motor car for the North Eastern Railway in England is described.—*Eng'ing News*, July 28.

Chicago.—An illustrated description of the Chicago underground freight railroad, covering the construction of the tunnel, the placing of telephone cables in it, the method of handling trains, etc.—*Iron Age*, August 4.

Multiple-Unit Control.—An illustrated description of the Westinghouse unit switch system of multiple-unit train control.—Lond. *Elec.*, July 15.

Inverted Third Rail.—An illustrated article on the use of the inverted third rail on the Brooklyn Bridge.—*St. R'y Jour.*, July 30.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Motor-Starting Switches.—HUNT.—An illustrated paper read before the Birmingham local section of the (British) Inst. Elec. Eng. on motor-starting switches and resistance. His paper is chiefly mathematical and discusses essentially the subdivision of the resistance and the sparking voltage between studs. Incidentally he remarks that an increase in the number of studs might be avoided by the construction of a switch on which any retractile movement of the starter contact should cause the circuit-breaking member of the switch to come into action. This could also be made to yield a further assistance by allowing the resistance winding to be made up in an inductive form, and so make that property assist in reducing the current peaks during the speeding up. In the discussion which followed Dix said he had found in designing standard starters not made to any particular specification, that if they were designed for about 0.6 full load it made the rushes of current at each step reasonable whether one starts the motor at full load or down to a quarter load. He thought sparking could be overcome, even with a moderate number of contacts, by good mechanical design. He has recently designed a switch of a simplified drum type, the drum being worm-shaped and geared with a rack to give slow motion. The design is illustrated. Gott has constructed starters according to the following practice: The total resistance is divided into three parts; the first part, starting at the armature, is divided "geometrically" into sections and is carried up to a point at which the resistance within the section contains the maximum difference of potential allowed. The second part contains equal sections and is taken up to the point at which the maximum current only will flow with stationary armature, and from that point to the end is the third section, which consists of a "geometrical" division with a new factor, this factor being found by the ratio of the last equal section to the total resistance then in circuit. The resistances plotted out to scale follow a curve with "geometrical" ends merging into a straight line center. His practice with regard to the sparking voltage has been 30 to 35 volts with a current of 100 amp., but he has used a value as low as 25 volts with 100 to 200 amp. and about 60 resistance sections to satisfy rigid specifications. Chattock always specifies the use of German silver or other wire that is not affected by oxidation and he has never had any real trouble with starters built in that way. Some oscillograph curves of the current rush during starting are reproduced, which were taken by Catterson-Smith.—Lond. *Elec.*, July 15.

REFERENCES.

British Central Station.—A note on the opening of the Frome (Somerset) electric lighting system. The power house contains two Parsons steam turbines, one for driving a 75-kw, direct-current dynamo, while the other is directly coupled to a 150-kw dynamo running at 3,500 r.p.m. Current is generated at 480 volts and distributed on the three-wire system. There is also a balancer booster set and a storage battery of 260 cells with a capacity of 400 amp.-hours.—Lond. *Elec.*, July 15.

Steam Turbine Power Plant.—A fully-illustrated description of the large new steam turbine power plant for lighting, traction and power purposes, of the Union Electric Company, of Dubuque, Iowa. The new type of four-stage Curtis steam turbines is employed involving the use of water step bearings and thereby obviating the use of oil for lubrication.—*St. R'y Jour.*, August 6.

Switches.—KLEMENT.—An illustrated article on constructions of switches for house connections and enclosed fuses.—*Elek. Zeit.*, July 14.

ELECTRO-PHYSICS AND MAGNETISM.

Radium and Uranium.—An account of some experiments made to determine the relative proportions of radium and uranium in certain mineral substances. The quantities of radium present were found to be apparently directly proportional to the quantities of uranium contained in the minerals. Since it has been suggested by J. J. Thompson and Rutherford as very probable that radium is formed by the breaking down of the uranium atom, and if such were the case a final state of equilibrium and a definite proportion between the radium and uranium present in minerals would be expected, the results of the author seem to furnish experimental evidence of the actual existence of this fixed relation.—*Am. Jour. Science*, August.

Electronic Theory.—WIEN.—A mathematical paper in which the author points out that if an electron at rest has a globular form, it must be assumed to get the form of an ellipsoid during motion. When the electron attains the speed of light it gets the form of a circular disc, while beyond that speed the charge of the electron would no longer be in stable equilibrium. The author believes that the considerations presented by him tend to emphasize the theory that all masses and forces are electromagnetic. "On the other hand, I would consider it as very detrimental for the further development of science if such theories based on hypothesis would be accepted as finally established." He recommends caution.—*Phys. Zeit.*, July 15.

REFERENCES.

Emanation and Radiations.—BERTHELOT gives some considerations on the new emission discovered by Blondlot. He points out that many of the so-called emanations may be due to gaseous matter condensed on solids and which can be discovered only by the most delicate chemical reactions. Volatile substances contained in the atmosphere may be condensed at the surface of bodies, or emanations may proceed from traces of organic matter derived from living organisms. Some of these organic matters adhere in an unaltered state. One of the difficulties of modern research is that the imponderable reactions are becoming more numerous and more delicate and cannot be followed up by means of the balance to which chemistry owes its rank as an exact science.—*Comptes Rendus*, June 20. MÜLLER has found strong radioactivity in fango, a fine mud which collects about some Italian thermal springs.—*Phys. Zeit.*, July 1. Blondlot describes minutely an improved method of recording N-rays by photography for proving their objective existence. He also describes several experiments to illustrate that the last kind of emission discovered by him behaves like an electric convection current, and can, therefore, be deflected by electric and magnetic forces; if not deflected in such way, the emission falls down through the air, in a vertical line. —*Comptes Rendus*, June 27. BLASS AND ZERMAK describes some

new photographic effects from zinc which they attribute to a radiation rather than to chemical action.—*Phys. Zeit.*, July 1. All these articles are abstracted in Lond. *Elec.*, July 15.

The Mercury Vapor Lamp as a Source of Ultra-Violet Light.—PFLÜGER.—An account of some experiments in which he has investigated the ultra-violet radiation of a mercury vapor lamp, made of fused quartz instead of glass. The energy of the ultra-violet radiation of his mercury vapor lamp is roughly 36 per cent. of the total radiation of a Hefner lamp, or about 38 times the energy in the visible spectrum of the Hefner lamp.—*Phys. Zeit.*, July 15.

Condensers.—EARHART.—An account of an experimental investigation in which he describes a method of applying the phasemeter of Lord Rayleigh to the general problem of dielectric hysteresis; he gives an expression for the determination of the efficiency of a condenser, subject to a simple periodic e.m.f., and finally gives the results of a long series of tests of condensers.—*Phys. Rev.*, July.

Lines of Force.—ZEDDIG.—An account of experiments for demonstrating the form of electric lines of force and especially the change of their direction by means of dielectrics.—*Phys. Zeit.*, July 15.

ELECTRO-CHEMISTRY AND BATTERIES.

Copper Refinery.—A fully-illustrated description of the works of the Balbach Smelting & Refining Company in Newark, which is the pioneer electrolytic copper refinery in the United States. After some historical notes the equipment of the copper refining room is described and illustrated and a method of casting the copper anodes is described, which is a combination of Walker's casting apparatus with a tilting mould of Thum. Since the slimes contain silver and gold, they are afterward worked up electrolytically. The bullion plates are used as anode and the electrolyte is a dilute solution of nitric acid. This changes to silver nitrate and the silver is deposited in crystalline form on the cathode which is arranged in form of a carbon plate on the bottom of the cell. The gold remains in the anode mud and is recovered from it. The works have also formerly used an electrolytic refining process for nickel.—*Electrochem. Ind.*, August.

Storage Batteries.—An anonymous article on the treatment of storage batteries. The writer emphasizes the importance of examining each individual cell periodically. He then speaks at some length of the disadvantages of overcharging and thinks that the best method for determining the length of a charge is to keep a record of the ampere-hours taken out during the previous discharge, and adjusting the time of charge correspondingly on the basis of a ratio between charge ampere-hours and discharge ampere-hours which has been previously determined once for all. A certain percentage excess of ampere-hours is to be given in charging and this excess is fairly constant for any type of grid; it may be anything between 8 and 12 per cent. He thinks the ampere-hours charged and discharged should be booked each day, with the final closed-circuit voltage at the end of discharge, and the hydrometer readings of the specific gravity should be booked once a month, but taken once a week.—Lond. *Elec. Rev.*, July 22.

Molecular Attraction.—MILLS.—A second paper in which the author presents additional evidence tending to show that the attraction between molecules varies inversely as the square of their distance apart and does not vary with the temperature. Considering the attraction as a property belonging to each molecule, or more exactly as a mutual property of each pair of molecules, it must vary as the mass, large numbers of similar molecules being here considered. The author endeavors to show that the law of gravitation holds, not only between masses, but between the molecules of a substance, and that this law is alone sufficient to account for the phenomena of the internal latent heat of vaporization.—*Jour. Phys. Chem.*, June.

REFERENCES.

Electrometallurgy of Iron and Steel.—MINET.—An illustrated description of the principal types of electric furnaces proposed for the electrometallurgy of iron and steel.—*Eng'ing Mag.*, August.

Electrometallurgy of Iron and Steel.—GUARINI.—The first part of a popular article on the subject.—*Scient. Am. Sup.*, July 30.

Power Transmission for Electrochemical Works.—See abstract of the article by Bell, under "Power."

UNITS, MEASUREMENTS AND INSTRUMENTS.

Localization of Earths on Feeders and Networks.—BOOT.—An article giving results obtained with the method indicated in Fig. 3. He employs a wire bridge divided up into 200 parts in order to obtain a direct percentage reading to avoid calculations. The flexible leads should be of the same sectional area as the cable which is being tested; if not, allowance should be made for the length from the point of the bridge. By using a two-cell storage battery a heavy current is sent around the cable, through the short-circuited end, and the resistance of the fault does not matter, since the galvanometer is connected across the same, and requires only a very small shunt current to deflect it. He uses a sensitive pocket galvanometer of the D'Arsonval type with a needle instead of a mirror. With this method

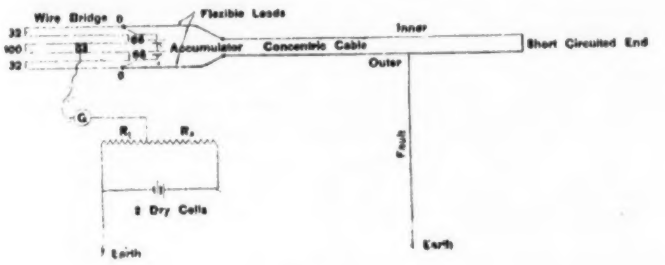


FIG. 3.

troubles were first experienced, since it was difficult to neutralize the earth currents without reducing the sensitiveness of the galvanometer. But this difficulty has been overcome by arranging a resistance R_1 and R_2, connected across a couple or more dry cells, one end being connected to earth and balancing the e.m.f. of the earth until no deflection is obtained on the galvanometer. Then on sending the current from the accumulators round the cable and moving the galvanometer contact along the wire bridge until no deflection is obtained, it is only necessary to read off the figure and take the percentage of the total length of cable, from which the distance of the fault along the cable can be obtained. The storage battery should be capable of giving about 20 amp. discharge current. He gives some results obtained in actual practice; they show that the method is very accurate.—Lond. *Elec. Rev.*, July 22.

Multiple Tariff Meter.—BAUMANN.—An illustrated description of his multiple tariff meter. He points out that it is preferable to have not only two, but more different tariffs, according to the hours of the day and the season of the year. A dial gives directly the price of the total consumed energy. The different tariffs are obtained in such a way that at periodic intervals the mechanism of the indicating dial (not the electric meter itself) is arrested for variable short intervals; the greater this interval, the greater is the discount allowed on the maximum price.—*Zeit. f. Beleucht.*, June 30.

Electric Meter.—An illustrated description of an electric meter of the Schuckert Company for measuring the energy which is consumed at a higher rate than contracted for. If, for instance, a consumer has the right to take 10 kw at any time and pays for this a certain lump sum per year, and if he wishes to consume 15 kw for one hour the meter must indicate 5 kw-hours, which are then charged for separately. The meter consists of an ordinary watt-hour meter provided with a device which prevents it from running backwards, and with another device which produces a constant backward torque, so adjusted that the meter just begins to run when the power agreed upon—in the above case 10 kw—is surpassed.—*Zeit. f. Beleucht.*, June 30.

Pyrometers.—An illustrated abstract of a report of a committee of the (British) Iron and Steel Inst. on pyrometers suitable for metallurgical work. The following instruments are described: Baird and Tatlock pyrometer; Callendar & Griffith thermometers, thermocouples, etc.; LeChatelier pyrometers; Roberts-Austin recording electric pyrometer; Siemens electric pyrometer.—Lond. *Elec.*, July 22.

Magnetograph.—WATSON.—A description of a new quartz-thread, vertical-force magnetograph in which a simple compensation for temperature is applied and the knife edge is eliminated so that irregularities produced by dust on the supporting plane are prevented. The principle of the instrument is similar to Threlfall's quartz-thread gravity balance.—*Terrestrial Magnetism*, June.

Horse-Power.—ZELEWESKI.—A communication suggesting the use of the sign HP for horse-power.—*Elek. Zeit.*, July 14.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Syntonic Wireless Telegraphy.—An account of a recent patent of Marconi for tuning the receiver. Fig. 4 shows the form which is considered most suitable. *a* is the receiving vertical wire adjustably connected to the inductance coil, *b*. The latter is connected to the condenser, *c*, which is again connected to a suitable receiver, *d*, like a magnetic detector, the other end, *e*, of which is earthed at *f*. Another ground connecting *g*, which is adjustable, is joined to the inductance, *b*, at a certain point, the position of which depends on the period of the electric wave radiated from the distant transmission station. The condenser, *c*, is fixed, while the point at which *a* and *g* are connected to *b* may be adjusted. The method of tuning is as

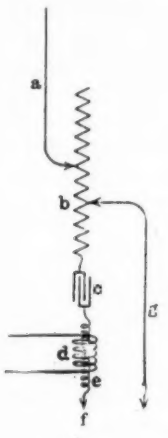


FIG. 4.

follows: The connection of *a* to *b* is first adjusted so that signals are received by the detector, *d*. Then by sliding the current connection, *g*, along the inductance, *b*, a point is found at which if a new current connection is established, waves of the particular frequency radiated from a given transmitting station will be received to the exclusion of signals transmitted from other stations radiating waves of other frequencies. The point of connection between *g* and *b* should be at or near the node (point of zero potential) of the electric wave which it is desired to detect.—Lond. *Elec.*, July 15.

Time Signals by Wireless Telegraphy.—BIGOURDAN.—A note proposing the wireless distribution of time signals which would offer special advantages to watchmakers and the makers of scientific instruments of precision. The directing clock which breaks an electric contact every second works a relay which in its turn sends a current into the primary circuit of an induction coil furnished with an oscillator. The secondary circuit of the coil thus provides an oscillating discharge of very short duration, which passes regularly every second. One of its poles is earthed while the other is connected with a vertical wire several meters high. The author tried two different receivers, one of them being a Popoff-Ducretet radiotelephone, while the other was an ordinary wireless receiver provided with a band chronograph passing 1 cm. of band per second. He obtained satisfactory transmissions over a distance of 2 km. In view of the accuracy of modern chronometers, the author considers it unnecessary to number the minutes, but he would make an interruption at every tenth second.—*Comptes Rendus*, June 27; Lond. *Elec.*, July 15.

Government Telegraph Rates.

In recent Washington dispatches it is stated that Postmaster-General Payne has issued a general order fixing the rates which telegraph companies shall charge on Government messages for the present fiscal year. It names the following rates, exclusive of place and date: For day messages of twenty words or more, 20 cents, not exceeding 1,000 miles, and one cent for each additional word, one-quarter of this rate to be added for each 500 miles or fraction thereof, but no rate on a message of twenty words to be more than 40 cents, nor over two cents for an additional word. The rate between all points in any State or Territory is fixed at 20 cents for twenty words, and one cent for each additional word. The night rate for messages of twenty words is 15 cents for any distance within 2,000 miles.

New Books.

USES OF ELECTRICITY ON SHIPBOARD. By J. W. Kellogg. New York: Marine Engineering. 78 pages, 23 illustrations. Price,

The rather slim volume contains a series of articles reprinted from *Marine Engineering*, to which has been added a chapter on storage batteries for launches, written by D. A. Richardson. The style of the author is descriptive, and examples from installations now in use are frequently given. The chapter on electrically driven auxiliaries gives interesting information as to the adaptability of electric motors for general power purposes. The treatment is throughout of a practical nature and the book should prove of good service to one who has not had special electrical training, but who wishes to learn of the requirements of electrical service on shipboard.

THE PRACTICAL TESTING OF DYNAMOS AND MOTORS. By Charles F. Smith. Manchester: The Scientific Publishing Company. 231 pages, 80 illustrations. Price, 5s.

This is a well-written book, the accounts of the tests being perspicuous and not unduly extended. The first chapter opens with a description of the "General Purpose of Tests," followed by "Practical Hints." Under this heading we find directions like the following: "Draw a complete diagram of connections before making the connections for an experiment. Be sure that the actual connections correspond exactly with the diagram." "Always insert a switch in the main circuit, even in cases where it is easy to start and stop the machine." These hints may seem rather elementary, but it is a good thing to be on the safe side in such matters, and many persons are more apt to neglect these fundamental precautions than less important matters.

The author states that the usual object of testing dynamos and motors is to ascertain whether they comply with the specifications, or are capable of performing certain duty. By properly conducted tests, however, it is possible to learn a great deal about the construction and the merits of the design. Following this line of inquiry, the book touches upon the more important considerations in design, so it covers a somewhat wider field than might be supposed from the title. In the preface the author says: "The use of mathematics has been avoided as far as possible," which is a characteristic of all well-written books. That is to say, no author of real merit would insert mathematics which were, in his view, unnecessary; the only question is as to what is really necessary to the elucidation of any given subject. The present author has succeeded with a few simple formulas. The book has real merit, and we wish it success.

Nernst Lamps for Buffalo Art Gallery.

The Buffalo office of the Nernst Lamp Company, in charge of Mr. G. E. Bennett as district manager, has recently obtained the contract for lighting the new Albright Art Building, of Buffalo, with Nernst lamps; the contract providing for the use of over 200 six-glower and a number of three-glower lamps. This building as planned by architects Green & Hicks, of Buffalo, is one of the handsomest of its kind in the country. It was donated to the city by Col. Albright, a prominent and wealthy citizen.

It may be mentioned that no expense was spared by the designers in determining the best system of lighting and elaborate tests were made, under the supervision of Mr. Bennett, comparing the Nernst with the arc and incandescent electric systems. Special attention was given to the respective abilities of the illuminants in bringing out the natural tints of the paintings and the architectural features of the interior in their true values. One unique feature of the lighting scheme is the location of the lamps for lighting the art galleries. All lamps are placed above the false skylight ceiling, so that no lamps are visible on the interior, and the light is projected through from above so as to strongly and evenly illuminate that portion of the side walls occupied by the paintings.

This installation, like that in the Exposition art galleries at St. Louis, would seem to indicate that the Nernst system has especial advantages for art gallery illumination. Over 1,500 three-glower Nernst lamps are used to illuminate the interior of the St. Louis art buildings and the results are universally conceded to be admirable.

Westinghouse Electric Interests at Home and Abroad.

Last week we presented in these pages the balance sheet of the Westinghouse Electric & Manufacturing Company, in regard to the issuance of new stock, viz., 50,000 shares at $80, par value $50. We now quote from the circular to stockholders the following data of interest:

After careful consideration of the interests involved your directors purchased from the Security Investment Company, of Pittsburg, under an agreement which insures a guaranteed profit to your company, $6,000,000 5 per cent. gold bonds and $3,000,000 of stock of the Lackawanna & Wyoming Valley Rapid Transit Company, a high-class electric double-track railroad between Scranton and Wilkesbarre, which was built by Westinghouse interests to demonstrate the capabilities of high-speed electric traction on a first-class line in a territory specially suited to such development. Extensive and valuable terminals, commodious stations and well-constructed roadbed, standard steel bridges and the most modern electrical equipment, render this road a model of its kind. The line has been in successful operation for several months, furnishing a train service of one, two and three-car trains on ten and twenty-minute headway, according to the requirements of travel, and has already developed a traffic exceeding that of any other existing interurban line for a like distance, with the possibility of much larger developments in the future following the completion of the tunnel at Scranton now under construction. The property has already been the subject of numerous investigations by parties interested in electric traction, and will continue to furnish a valuable object lesson in the electrification of main line railways, which has been commenced recently by some of the most important steam lines. As a result of the improved transportation facilities furnished by this railway, there will also undoubtedly be in the near future a large development of manufacturing and other industries in this territory in view of the low cost of anthracite fuel and its availability for the cheap production of electric power by means of gas engines and otherwise, to the advantage not only of the Lackawanna & Wyoming Valley Rapid Transit, but of the several steam railways operating in the same field, viz., Delaware, Lackawanna & Western, Delaware & Hudson, the Erie, the Lehigh Valley, the Ontario & Western and Pennsylvania Railroads.

A favorable opportunity having been found last January to sell $2,000,000 of the company's two-year 6 per cent. notes, and a further opportunity during the present month to sell $4,000,000 three-year 5 per cent. notes all secured by Lackawanna & Wyoming Valley bonds, such opportunities were availed of in order that the company might have the use of these funds until such times as the bonds could be advantageously sold, which it is expected may be done before the maturity of these notes, provision having been made in the issue thereof for their retirement. The construction of this railway has, therefore, been financed largely on its own securities and affords a vehicle for advantageously promoting the advertisement and sale of your manufactures.

The British Westinghouse Electric & Manufacturing Company, Limited, at a special meeting of its shareholders held February 5, 1904, for the purpose of raising additional capital required in its business, authorized a further issue of £500,000 of new preference shares. Under the terms of the articles of association of the company, this increase of share capital had the effect of also authorizing a further issue of debenture stock. The authorized capital of the company is now as follows: Six per cent. preference shares, £2,500,000; ordinary shares, £750,000; 4 per cent. mortgage debenture stock, £1,462,500. The difficulty of finding a market in England for industrial securities of any character, due to the general depression of trade in that country, rendered necessary the purchase by your company of £500,000 additional preference shares at par, which purchase has recently been completed, and the further purchase of £450,000 at 95 per cent. of par, of the 4 per cent. mortgage debentures of the above company, the payment for which has just been consummated by a credit to your company of £100,000 on current account, covering material supplied, and a payment of the balance in cash. The investment of your company in the above-named company is now as follows: Four per cent. mortgage debenture stock, £450,000; 6 per cent. preference shares, £894,020; ordinary shares, £375,460. The latter shares are entitled to three-quarters of the divisible earnings after paying the interest on the debentures and 6 per cent. on both preference and ordinary shares. The assets and liabilities of the British Westinghouse Electric & Manufacturing Company, Limited, based on the preliminary balance sheet of April 30 (which is subject to a verification of the official auditors of the company), are as follows:

ASSETS.

Quick or working assets (cash, accounts receivable, work in progress, material, etc.		£1,164,031:17: 6
Real estate, buildings, machinery, tools, etc.		2,042,125: 0: 5
Securities held as investments		254,232: 5: 9
Patents, etc.		808,906: 3: 6
Total		£4,269,295: 7: 2
Stock Outstanding—Preferred shares	£2,355,000	
Ordinary shares	750,000	
		£3,105,000: 0: 0
Four per cent. debenture stock		616,353: 0: 0
Accounts payable, etc.		464,749:12:10
Surplus		83,192:14: 4
Total		£4,269,295: 7: 2

The payment of the balance of £145,000, due April 30, 1904, on the sale of preference shares, and the sale of the remaining £400,000 debenture stock, will give to the treasury of the British Company additional cash amounting to $545,000. The property and facilities of the British Westinghouse Electric & Manufacturing Company, Limited, are exceptionally complete and the prospects for a profitable business are excellent, but, as was the case with your own properties, there will be needed time and money to round out so important an operation.

The condensed balance sheet of the Société Anonyme Westinghouse, of France, follows:

Assets, December 31, 1903:		
Quick or working assets (cash, accounts receivable, work in progress, materials, etc.)	Fcs.	6,575,803
Real estate, buildings, machinery, tools, etc.		7,640,339
Investments—Securities held as investments		174,300
Patents, etc.		9,492,453
	Fcs.	23,882,895
Liabilities:		
Stock outstanding	Fcs.	20,000,000
Accounts payable		2,188,807
Loan from bankers		1,500,000
Surplus		194.088
	Fcs.	23,882,895

An issue of debentures has been authorized to provide further working capital. There have recently been elected to the board of the French Company several influential French directors having extensive commercial relations, who first made a most careful investigation of the affairs of the company. It is believed that with the influence of these gentlemen in the securing of orders, the business and earnings of the company will be greatly increased. Your company now owns 11,755, at 500 francs par, shares in this company, and during the past year has advanced 375,000 francs and has guaranteed the loan of a like amount, for which sums it will in due course receive debentures.

The Canadian Westinghouse Company, Limited, was formed last year by an agreement between the Westinghouse Air Brake Company, of Pittsburg, and your company to enlarge the works which the former company had established at Hamilton, Ontario, so as to provide for the manufacture of electrical apparatus required for the execution of the many orders which your company has been able to secure in Canada. The assets and liabilities of the company, according to the last balance sheet, were as follows:

BALANCE SHEET, MAY 31, 1904.

Assets:	
Quick or working assets (cash, accounts receivable, work in progress, etc.)	$1,100,451
Real estate, buildings, machinery, tools, etc	213,104
Patents, etc.	1,050,000
	$2,363,555
Liabilities:	
Stocks outstanding	$2,264,200
Accounts payable	56,846
Surplus (seven months' business)	42,509
	$2,363,555

Your company received for its patents and the good will of its business in Canada $500,000 in full paid shares, and subscribed for a further $450,000 at par. The works of the Canadian Westinghouse Company, Limited, are approaching completion. In the meantime its business is being rapidly developed. Considering the large field of operations, it is anticipated that the earnings of the company will be sufficient to pay regular dividends.

In the operation of trains by electricity, as on the elevated roads in Chicago, New York and Boston, and on the underground railway in New York, it has become necessary to have a control of operating apparatus whereby a motorman can, from a front compartment,

operate all the motors upon a train. The Westinghouse Air Brake Company, by reason of its arrangement with Mr. George Westinghouse in regard to pneumatic inventions, developed an electro-pneumatic system of train control which it is believed is superior to other forms. To avoid controversy with the General Electric Company on the subject, it was deemed wise by your board of directors to purchase from the Westinghouse Air Brake Company such patents as it had acquired or might hereafter acquire relating to electro-pneumatic control devices for $1,000,000.

The new east extension of your works at East Pittsburg has been completed and partly occupied. Its cost to March 31, 1904, including the new machinery installed, amounts to $3,237,304. Additions have also been made to the Bryant plant, at Bridgeport, Conn., and to the Newark works. These increases in manufacturing facilities will enable your company to meet a demand for electrical apparatus aggregating in value $3,000,000 per month.

From the foregoing review of the finances of your company, it will be seen:

(1) That securities of large and increasing value have been acquired and are held in your company's treasury, a large amount of which are available for sale at a favorable opportunity.

(2) That the foreign interests of your company have been developed and closely identified with those of the parent company and rendered secure and stable thereby.

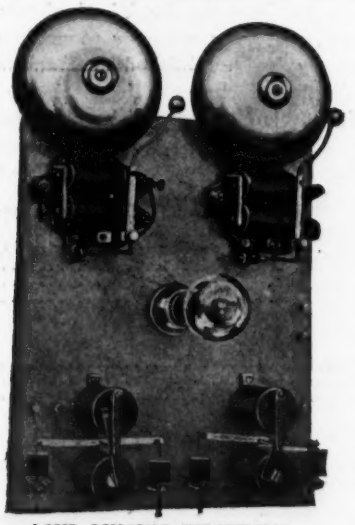
(3) That large investments in working assets, a large surplus and a moderate share capital are elements calculated to secure the future stability and success of your company, placing it in a most advantageous position with reference to competition.

The outstanding capital of your company will, upon the sale of the remaining 50,000 shares of stock, be $25,000,000. Your directors have believed it a conservative policy not to create and issue a large amount of capital stock, but to develop and enlarge its domestic business and protect its foreign investments by loans which can be retired on the accumulation of marketable securities.

Telephone for Central Stations.

Mr. G. M. Lee, of Tariffville, Conn., has brought out a telephone device intended specially for use in central station work. He noted while in the employ of the Hartford Electric Light Company that the small telephone bells were inadequate, as the dynamo tenders and others could not hear them on account of the noise of the machinery. He devised, therefore, the present "noisy alarm" apparatus, which makes all the racket required.

The device is practically an extension bell for a telephone circuit. These bells may be of any size, and are used with batteries, and may be used either on a battery or dynamo telephone circuit, the latter direct current. The small magnets at the bottom are connected into the telephone circuit in multiple. When the magneto is rung, the armature of the attachment completes the local circuit through a mercury cup and rings the large bell.

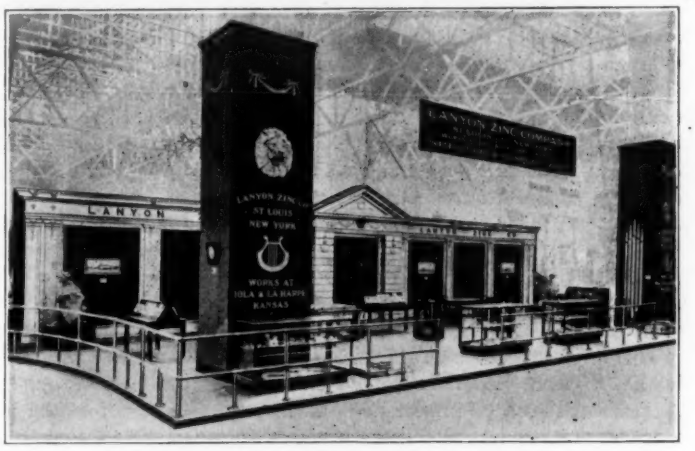


LOUD RINGING TELEPHONE.

The instrument shown is double for two separate telephone circuits; they are reliable for single or vibrating bells. A call like 1-2 or 1-6 or any other combination of numbers is immediately reproduced with as loud a tone as the size of the bell will permit. A number of these bells are in use, and they are giving satisfaction. It is an instrument which any one needs who requires a reliable attachment giving a loud telephone ring to be heard in spite of abnormal or distracting noises.

An Exhibit of Zinc at St. Louis.

Zinc for battery parts and similar uses has long been familiar to the public in general and the electrical world in particular, but outside the knowledge that it is used for some other things, very little of the value and diversity of uses of zinc is appreciated even to-day, while the development of this metal has in fact been a rapid one. This development is well illustrated at the exhibit of the Lanyon Zinc Company in the Mines and Metallurgy Building at the St. Louis Exposition, where this company has gathered together a great number of articles manufactured in zinc, from the familiar washboard and battery rods to solid zinc nails and organ pipes. The cheapness, lightness and durability of zinc render possible its substitution for many other of the more expensive metals such as copper and brass. The use of zinc for shoe eyelets is an example of this, and is only one of the cases of efficient substitution among many which might be mentioned.



ZINC EXHIBIT AT ST. LOUIS.

The Lanyon Zinc Company, although at present manufacturer of spelter, sheet zinc, zinc wire rod and band only, has sought to exploit the various zinc workers with a view of extending the consumption of its manufactured products, and to enlighten the general public regarding the nature, properties and applications of zinc, knowing that the more general the knowledge of its adaptability becomes, the better will it be applied and eventually employed for a much wider diversity of products.

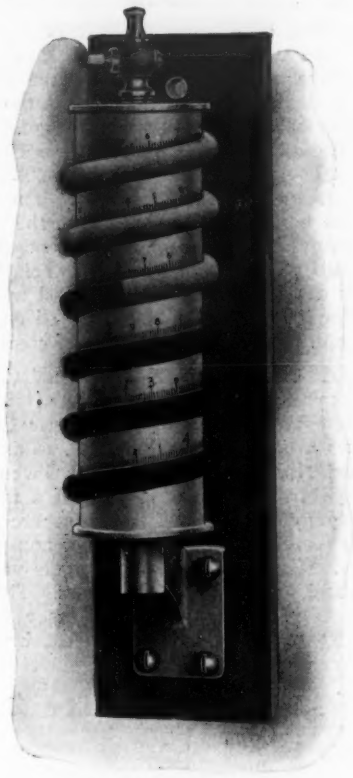
The architectural uses of zinc are represented in this exhibit by a 66-in. facade of classic proportions worked in sheet zinc and stamped zinc ornaments, and by the zinc tile roof upon the metal pavilion just outside the Mines and Metallurgy Building. The company's direct product is shown in several piles of spelter, casks of sheet zinc, and a large display of rods, wire, tubing and bands.

A Draft Gauge.

The importance of being able to tell at a glance the chimney draft is fully recognized by the operating engineer, and the necessity of knowing the pressures maintained, where quantities of air are moved, is becoming more apparent to ventilating engineers. Moreover, in testing gas engines for their thermal efficiency, the pressure of the gas as well as the barometer readings must be accurately recorded if correct results are desired.

For such purposes an ordinary U-shaped glass tube has been used and the difference of the level of the liquid in the two legs taken as the pressure. Aside from the fact that one can seldom read closer than one-fourth of an inch on account of the menisci varying with the direction of movement of the liquid, that two readings must be taken to get the correct result and that the tube is fragile and often gets broken, the device gives good results. In order to read closer than one-fourth of an inch, a glass tube has been used in an inclined position, giving a 10-in. travel for 1-in. rise. This makes the readings finer, but limits the range for practical purposes, as a tube showing a difference of pressure of 6 in. would be 5 ft. long.

The necessity of accurate determinations and the desirability of a strong, portable, direct-reading, ornamented, unbreakable draft gauge or monometer which can be mounted on a gauge board and which can be read to one-hundredth of an inch and of a capacity of 6-in.



A DRAFT GAUGE.

pressure or vacuum, led to the invention of the instrument shown.

It consists of a nickel-plated brass cylinder, closed at both ends, encircled with a spiral groove in which is wound a transparent flexible celluloid tube, the bottom end of which is cemented in and communicates with the interior of the brass chamber. An extension of its lower head passes through the bracket, which supports the gauge, yet allows it to be revolved at will, around its vertical axis. The whole device can be attached to a gauge board if desired. A small hose cock to which a rubber tube can be attached admits pressure through the top head of the cylinder. Distilled water, usually colored, is put in the cylinder through this cock until the zero mark is reached on the scale.

Pressure will cause the level of the liquid to ascend in the tube and for every inch of vertical rise it will travel around the cylinder a distance of about 9 in., which is divided into 100 equal parts. The angle of the tube is such that the plane of the miniscus is radial, making close reading possible. The cylinder can be rotated so that the level of the liquid comes on the front side.

Rarefaction causes the liquid to descend, and by adjusting the cock any degree of steadiness of the level in the tube may be obtained. The upper end of the tube is closed with a screwed brass plug and the inlet cock is shut when the gauge is carried about, maintaining the liquid in place without danger of spilling.

As the tube is tough and elastic, it is not liable to be broken. The whole device is 3 in. in diameter by about 12 in. long, and weighs about 3 pounds. It is sold by Schæffer & Budenberg, New York and Chicago. The instrument was invented by Mr. C. E. Sargent, of Chicago.

Blue Light in Dentistry.

A cable dispatch that recalls to students of psychology and new cures the famous "blue light" craze of some years ago is dated from London August 9: "A dispatch to the *Daily Mail* from Geneva says that Prof. Redard and Prof. Emery have discovered a new anæsthetic for use in dentistry. Experiments to learn the effects of colored lights upon the nerves revealed that blue light is extraordinarily soothing. A patient was put in a dark room and his eyes were exposed to a 16-cp blue light for three minutes. This caused him to lose the sense of pain, and the tooth was then painlessly extracted without the after effects of ether or chloroform."

Cut-Out and Fuse Exhibit at St. Louis.

The D. & W. Fuse Company, of Providence, R. I., is exhibiting in Electricity Building, St. Louis, through its agents, the Western Electric Company, two sample boards of its well-known specialties. The boards are shown herewith in Figs. 1 and 2. Board No. 1 dis-

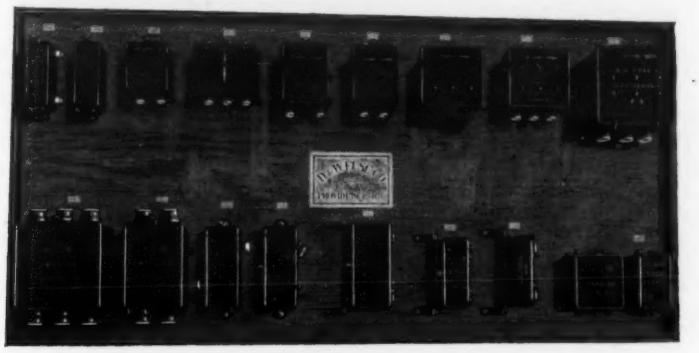


FIG. 1.—CUT-OUT AND FUSE EXHIBIT.

plays a complete line of boxes designed to operate satisfactorily on circuits ranging from 250 to 6,000 volts and comprising the following types: Transformer cut-outs, service switches and boxes, entrance cut-outs and railway cut-outs, all equipped with enclosed cartridge fuses, the types of contacts of the fuses varying according to the conditions for which the boxes are designed, some having the well-known clamp contact where extreme vibration renders a clip fuse impracticable, while in other boxes the spring clip fuse is used.

On board No. 2 are mounted a complete line of low-potential cut-outs of the spring clip type and also type "A" or screw clamp contacts. This applies also to the 500 and 2,500-volt cut-outs and fuses. In addition to the bull's eye indicating cartridge fuses, several other

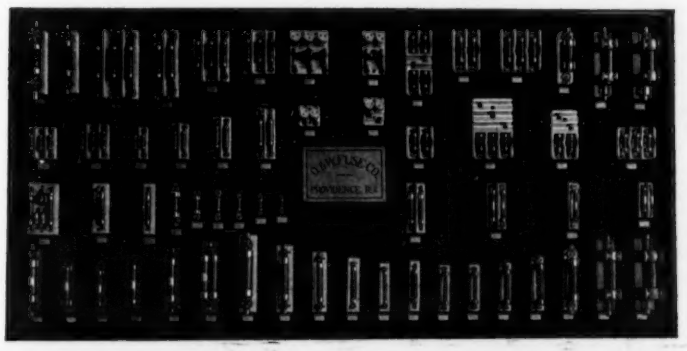


FIG. 2.—CUT-OUT AND FUSE EXHIBIT.

specialties are shown, such as re-loadable plug fuses and several types of panel fuses; also telephone, telegraph and fire alarm protectors.

The boards are made of cherry, 8 ft. by 5 ft., with aluminum name plates under each of the articles giving the catalogue number.

Racetrack Telephones.

Justice White, after hearing a further appeal on the subject, in the Supreme Court in Brooklyn, N. Y., has granted a peremptory writ of mandamus directing the New York Telephone Company to restore its service to the New York & New Jersey Distributing & Circulating Company. This is the news distributing bureau with offices in the Park Row Building which was raided as a poolroom exchange by Inspector Schmittberger last May, the inspector acting under instructions from Police Commissioner McAdoo. The poolroom interests take the decision of Justice White to mean a complete victory. Counsel for the distributing and circulating company immediately took the necessary legal steps and before the day was over the telephone instruments in the offices of their clients, which had not been working since the day of the raid, were connected and the concern was in precisely the same shape as it was before the police swooped down upon it. It will be remembered that but recently a contrary decision was rendered in another court.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET saw business on a limited basis, with dullness in stocks, little demand for money, and small shipments of gold to Europe. Stocks were off in the earlier part of the week, as a result of war alarms and anxieties, but rallied toward the close, with general firmness and recovery. While there were fluctuations from day to day, very little change was noticeable as between the two weeks. In a word, the market is a waiting one, though not by any means uneasy. On the contrary, it almost seems to jump at the chance to improve, and is much easier to advance than to put back. Wall Street is not quite clear, however, as to the view it should take of the present "dollar wheat" phenomenon. Stock quotations follow:

NEW YORK

	Aug. 2	Aug. 9		Aug. 2	Aug. 9
Allis-Chalmers Co	11	11	Electric Vehicle	9	9
Allis-Chalmers Co. pfd	48	48	Electric Vehicle pfd	13⅜	14
American Tel. & Cable	87	90	General Electric	162⅛	163½
American Tel. & Tel	134¾	159	Hudson River Tel.	..	..
American Dist. Tel	22	22	Metropolitan St. Ry.	118¾	123⅞
Brooklyn Rapid Transit	51¾	53	N. Y. & N. J Tel	147	152
Commercial Cable	181	186	Marconi Tel	..	..
Electric Boat	40	39	Western Union Tel	88	89
Electric Boat pfd	76	66	Westinghouse com	155	159
Electric Lead Reduction	1	1	Westinghouse pfd	170	..

BOSTON

	Aug. 2	Aug. 9		Aug. 2	Aug. 9
American Tel. & Tel	134¾	139½	Western Tel. & Tel. pfd	91½	92
Cumberland Telephone	116¾	118	Mexican Telephone	1¾	..
Edison Elec. Illum	249	259	New England Telephone	124	124
General Electric	162	163	Mass. Elec. Ry	17⅛	17⅛
Western Tel. & Tel	13¾	14	Mass. Elec Ry. pfd	69⅛	..

PHILADELPHIA.

	Aug. 2	Aug. 9		Aug. 2	Aug. 9
American Railways	47	47⅝	Phila. Traction	..	98¾
Elec. Storage Battery	60	..	Phila. Electric	6⅛	6⅝
Elec. Storage Battery pfd	60	..	Phila. Rapid Trans	12⅝	..
Elec. Co. of America	8¾	9			

CHICAGO

	Aug. 2	Aug. 9		Aug. 2	Aug. 9
Central Union Tel	..	..	National Carbon pfd	104	..
Chicago Edison	..	..	Metropolitan Elev. com	20	19
Chicago City Ry	170	..	Union Traction	..	..
Chicago Tel. Co	120	..	Union Traction pfd	..	..
National Carbon	30½	33			

LIGHT AND TROLLEY DEAL AT FORT WAYNE.—The report is given out of the acquisition of the Fort Wayne Electric Light Company, by the Fort Wayne & Wabash Valley Railway Company. This will give the Fort Wayne & Wabash Valley control of all the electric lighting business in the city of Fort Wayne, Ind. It is also reported that negotiations have been closed for the purchase of the Fort Wayne & Southwestern Electric Railway, which is controlled at present by New York and New England interests. The Fort Wayne & Southwestern operates a line of 45 miles between the cities of Fort Wayne and Wabash. The result of this purchase will be to give to the Fort Wayne & Wabash Valley entire control of the through interurban line of 75 miles connecting the cities of Fort Wayne, Huntington, Wabash, Peru and Logansport. The Fort Wayne & Wabash Valley is largely controlled by the same Philadelphia interests who are interested in the Indiana Union system of 160 miles, which by north and south lines connects Indianapolis with the Fort Wayne & Wabash Valley system at Logansport and Peru. The connection at Peru is expected to be in operation about August 15, and at Logansport a month or two later. It is understood that interests friendly to the Fort Wayne & Wabash are constructing a line from Fort Wayne to Lima, a distance of 60 miles.

CONNECTICUT RAILWAY & LIGHTING.—Redmond & Company, of New York and Philadelphia, and J. & W. Seligman & Company, of New York, offer to investors $1,500,000 first and refunding mortgage 4½ per cent. sinking fund guaranteed gold bonds of the Connecticut Railway & Lighting Company at 97½. These bonds are due in 1951 and interest is payable in January and July. They are redeemable at 105 and accrued interest. The interest is guaranteed by endorsement on each bond by the United Gas Improvement Company, of Philadelphia. These bonds are secured by a mortgage on the entire property of the company and by a first mortgage on the greater part thereof. The 175 miles of electric road owned serves directly nineteen cities and towns situated along the highly prosperous and rapidly growing southern shore of Connecticut and the valley of the Naugatuck, including Bridgeport, Waterbury, etc. The combined population in 1900 was 465,748, an increase of 35 per cent. over 1890.

MARYLAND TELEPHONE & TELEGRAPH.—Philadelphia capitalists, headed by Sidney Wright, a broker, with offices in the Mariner and Merchant Building, will, it is reported in financial circles, refinance the Maryland Telephone & Telegraph Company this fall. The active work of rearranging the company's financial standing will, it is said, begin as soon as George R. Webb, who is in charge of the company, returns from abroad. According to the present plans, an effort will be made to issue $6,000,000 of new bonds, of which $2,000,000 will be used in establishing modern electric lighting and power plants in Maryland. The remainder will be used to retire the first mortgage bonds of the concern and as a medium of exchange for the second and general mortgage bonds. The present capitalization of the Maryland Telephone & Telegraph Company consists of $1,000,000 5 per cent. first mortgage bonds, $1,155,000 outstanding of an authorized issue of $4,000,000 of second mortgage 5 per cent. bonds, and $1,000,000 of common stock.

TROUBLES OF HUTCHISON ACOUSTIC.—Judge Scott, of the New York Supreme Court, has appointed John T. Sproull receiver of the assets of the Hutchison Acoustic Company, manufacturer of appliances to improve hearing, Nos. 18 and 20 West Thirty-fourth Street, and Nos. 110 and 114 West Twenty-third Street, in a suit brought by Mr. Sproull as trustee of a mortgage of $50,000 made by the company in February last to secure an issue of bonds, in proceedings to foreclose the mortgage for non-payment of interest due on August 1. The assets consist of tools valued at $2,000, accounts of $7,000 and patents, value not given. The company was incorporated in October, 1901, as a New Jersey corporation, with a capital stock of $500,000 and in January last was reorganized as a New York corporation. At that time its plant and machinery were valued at $40,000.

BUFFALO GENERAL ELECTRIC STOCK.—Holders of stock in the Buffalo General Electric Company have received notices that a meeting will be held at the offices of the company on Aug. 17 to vote on the proposition to increase the capital stock of the company from $2,400,000 to $5,000,000. It is said that those holding a controlling interest in the company have determined on the increase and it will go through. The reason given by Charles R. Huntley, vice-president and general manager of the company, for the proposed increase of stock is the necessity of getting into position to meet the growing demand for electricity. The Buffalo General Electric Company was organized in 1893 with a capital stock of $1,800,000. Its president is Daniel O'Day, of New York City. The stock is quoted at 105 and pays 5 per cent. dividends.

DIVIDENDS.—The Worcester Railways & Investment Company, the holding company of the Worcester Consolidated Street Railway properties, has declared a semi-annual dividend of 2¼ per cent. The directors of the Niles-Bement-Pond Company have declared the regular quarterly dividend of 1½ per cent. on the preferred stock and a semi-annual dividend of 3 per cent. on the common stock. The common dividend is a reduction of 1 per cent. as compared with the previous payment, making 7 per cent. for the year. Directors of the Pratt & Whitney Company have declared the regular quarterly dividend of 1½ per cent. on the preferred stock. The Columbus (O.) Railway Company has declared the quarterly dividend of 1¼ per cent. on preferred stock.

NATIONAL WIRE VOTING TRUST.—It is announced that steps have been taken toward the creation of a voting trust for the National Steel & Wire Company. If the plan is finally adopted the trustees will be H. A. Huntington, Ogden Mills and Henry W. Munroe. The trust will be created for three years. Stock favoring the centralization of the administration will be deposited with the Knickerbocker Trust Company. One plant of the National Steel & Wire Company is at New Haven, Conn., and the company has a capitalization of $2,577,800 of preferred stock and $2,993,700 of common. E. B. Webster is president of the company. Headquarters have been established recently at 114 Liberty Street, New York, at the former office of the absorbed Safety Insulated Wire & Cable Company.

ELECTRICITY AND INTERBOROUGH.—An official estimate was made public this week to the effect that the receipts of the Interborough Company from excess earnings of Manhattan Elevated above 7 per cent. guarantee, and from advertising privileges already contracted for, will pay all fixed charges and 3½ per cent. interest on the $35,000,000 of New York City bonds issued to build the underground road. The company's experts figure that Interborough will pay about 8 per cent. from the opening of the subway.

UNITED STATES TELEPHONE.—This long-distance independent company reports for the five months ended May 31: Gross earnings, $169,487; operating expenses and taxes, $99,865; net earnings, $69,622; charges, $41,671; surplus, $27,951.

Commercial Intelligence.

THE WEEK IN TRADE was of a somewhat mixed character, conditions in general being good while special facts were not encouraging. Thus excellent reports of the corn and cotton crops, and the higher quotations for wheat, were offset by new labor troubles, including a builders' lockout in New York. Railway net earnings were also smaller and bank clearings were less. But the iron and steel situation was better, and the coal trade brightened up. Bank clearings for the week ending with August 4 aggregate $1,809,148,521, 1 per cent. less than last week and 7 per cent. under last year. Exchanges outside New York City total $747,792,657, an increase of 2.7 per cent. over last week, but a loss of 4 per cent. as compared with last year. Business failures for the week ending August 4 number 179, against 174 last week, 161 in the like week in 1903, 169 in 1902, 185 in 1901 and 172 in 1900. During the week metals were dull, and copper, New York, was quoted at 12½ cents.

POWER FOR MOSCOW, IDAHO.—The Moscow Electric Light & Power Company, which has contracted with the Lewiston-Clarkston Company for 1,000 horsepower from the electric energy to be generated at the mouth of Grand Ronde River, is preparing for the new electric plant to be put in. The local company will have charge of the distribution of all power used north of Snake and Clearwater Rivers. The power will be transmitted under 23,000 voltage, which will then be transformed to 2,200. This will necessitate the complete renewal of the Moscow light and power plant operating at a voltage of 1,000. A new substation will be erected, which will be connected with the present steam plant, so that it can be used in case of necessity. New poles and wires will be stretched and the system entirely made over. The company has entered into a 10-year contract with the Genesee City Council to provide power for the city water works and also to light the streets with arc lights. For pumping purposes a 30-horsepower motor will be used. Work on the Genesee electric light system will be commenced at once and pushed to completion by August 15. Under the contract the Moscow Company is to furnish power for the city pumps in Genesee by September 1. Contracts have also been made with C. E. Woods, of Genesee, to furnish him 75-horsepower of electricity to be used in running two flour mills there. The Moscow Company will also put in electric light plants at Uniontown and Colton. At the former place a motor will be put in and power furnished for running the water works pumps. The company is negotiating with a number of other towns in Whitman County to furnish power and light. It is estimated that the company has an immediate market for about 900 to 1,000 horsepower, and that by the time the Grand Ronde dam has been completed fully as much more power will be needed to supply the demand north of Snake River.

WIRELESS TELEGRAPH APPARATUS.—The Navy Department has purchased from the American DeForest Wireless Company six sets of electrolytic receivers for use in navy service. The object of the Navy Department in purchasing these receivers was to displace the German instruments now in use. The instruments are deliverable at the Navy Yard, Brooklyn. This is regarded as signifying the intention of the Navy Department to Americanize the wireless telegraph system of the Navy. The same company is now operating commercially at regular telegraph rates an overland service from the fair grounds, St. Louis, to Springfield, Ill., a distance of 105 miles. Within two months the station on the building at No. 42 Broadway will be completed and in communication with New Haven and Philadelphia. Communication with Boston will be opened up this fall from the station at Navesink Light to a station to be installed at Cape Cod. The intention is to use stations for private telegraphic work in the daytime and press work at night. Already the New York *Times* has signified its readiness to avail itself of the night service between New York and Philadelphia so soon as the company can install its apparatus on the *Times* building.

SOME HEINE BOILER ORDERS.—The Heine Safety Boiler Company, Bowling Green Building, has just secured another contract for boilers to be installed in the Syracuse, N. Y., Electric Lighting Company's plant. This time a 1,000-hp outfit in three units has been requisitioned for. This will make 3,000 horsepower of Heine boilers for the same plant. Sibley, Lindsay & Kurr Co., of Rochester, N. Y., which concern's big department store was burned during the recent fire, has placed a contract with the Heine people for two 300-hp boilers for the new plant. Mr. J. Foster Warner, of Powers' Block, Rochester, is the architect for the new buildings. The New York Central & Hudson River Railroad Company has ordered a 250-hp Heine boiler set for its Minoa, N. Y., lighting plant. The Onondaga County Court House, Syracuse, N. Y., plant is to have a 500-hp equipment of four boilers of 125 horsepower each.

ELECTRIC STORAGE BATTERY.—President Herbert Lloyd, of the Electric Storage Battery Company, is quoted in Philadelphia as saying: "I consider the prospects for business this fall very good. We are already stocked with orders for several months. Experience seems to prove that large electrical companies find it economical often to retrench by putting in storage batteries instead of installing additional motive power. Notwithstanding the general flat time, I believe that our earnings for 1904 will show an increase over those for 1903, even although for the six months ended June 30 we may be a little behind. It is safe to say that there will be no reduction in our October dividend."

THE NERNST LAMP COMPANY has recently obtained through its Philadelphia office in charge of A. E. Baker, the contract for lighting Rocky Glen Park, of Scranton, Pa., with 100 six-glower lamps. It may also be mentioned that the Pennsylvania Railway Company is finding the lamp a success in depot lighting, and has recently made a substantial addition to its Philadelphia installations. The Philadelphia Nernst office has also recently secured the adoption of Nernst lamps by the Paxtang Electric Company in Harrisburg, Pa., and it now has over 2,300 glower units in service on its circuits.

STORAGE BATTERIES FOR TAMPICO.—The Fabrica de Acumuladores, S. A., of Berlin and Hagen, Germany, will install one of its storage battery systems in the new electric lighting plant of Tampico about the first of September. W. H. de Waal, manager of the company in Mexico City, will go to Tampico at that time to personally superintend installation. The batteries for the new plant will be sufficient to supply 5,000 volts of electricity. The city of Tampico, upon the completion of the lighting plant, will have a good electric system, there being two boilers of 200-horsepower each already installed.

WIRELESS FOR MOROCCO.—F. Z. Maguire, the English representative of the De Forest Wireless Telegraph Company, says that the company has made contracts for twenty wireless stations in Morocco and for stations connecting the various islands of the Azores. It is expected that in a short time it will be possible to send messages from the interior of Morocco to the coast without fear of the wires being cut by brigands. The rocky condition of the ocean bed makes it difficult to lay cables connecting the Azores, and the wireless system will therefore supply a long-felt want.

THE KNICKERBOCKER CONSTRUCTION COMPANY, of 15 Cortlandt Street, New York, have been awarded the contract for the installation of the underground and aerial cables for the new Lewiston-Auburn, Me., Automatic Telephone Company, amounting to over 100,000 feet. The cable is being manufactured by the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., and Chicago.

EQUIPMENT FOR OFFICE BUILDING.—The plant of the new office building to be built on Fifth Avenue and Thirty-second Street, owner, Mrs. Mary Bell, is to be installed with a 330-hp equipment, consisting of two 125-hp Harrisburg standard engines arranged for direct connection to 75-kw Sprague generators and one Harrisburg engine of 80 hp capacity for direct connection to a 50-kw Sprague generator.

BUCKEYE ENGINES FOR CLEVELAND SKYSCRAPER.—The engines to be installed in the $1,000,000 skyscraper which Mr. John D. Rockefeller is having constructed in Cleveland, will be built by the Buckeye Engine Company, of Salem, Ohio. Clark & McMullen, of 25 Broad Street, New York, are acting as consulting engineers in the matter.

GERMAN ELECTRICAL EXPORTS for the first three months of 1904 were considerable. Electric machinery is reported at $1,309,000, and in addition to that electric motors amounted to $975,800. The tonnage of electrical apparatus for the first quarter of 1904 was 3,776, as against 2,913 tons in the corresponding quarter of 1902.

ELECTRICAL EQUIPMENT FOR GOLD MINE.—Rudolf J. Decker, of Salt Lake City, has been awarded the contract for the electrical equipment in the Carrizal Gold Mining Company, State of Michoacan. The New York offices of the company are at No. 33 Gold Street.

MOTORS FOR A SHOE FACTORY.—William H. Morse, electrician, has just installed in the factory of the Barton Shoe Company, Newburyport, Mass., five General Electric motors of a total of 15½-horsepower, for the work of the factory.

GEORGE S. HASTINGS & COMPANY, Cleveland, representing the Niles Car Manufacturing Company, of Niles, Ohio, has secured a contract for 10 28-ft. closed city cars for the Montreal Street Railway Company, of Montreal, Canada.

CHARLEROI, Pa.—The Monongahela Valley Electric Company is in the market for 300-hp boilers, 1 arc machine, 1 d. c. power generator, 600-hp engines and other machinery.

WATERTOWN FIRE WIRES.—The contract for the placing of a conduit for the fire alarm wires has been awarded to the Standard Underground Cable Company, of New York, its bid being $2,461.

HUGE PURCHASES PENDING FOR NICARAGUA.—Some very large contracts for electrical equipment will, it is expected, be ordered shortly in this market for shipment to Nicaragua for use in the development of an extensive mining country, the concession for which has been acquired by the American Mining Company, recently incorporated by Pittsburgers, under the laws of the State of Maine, with a capital of $1,500,000. Mr. Thomas B. Riter, of the Riter-Conley Manufacturing Company, is president of the concern; Mr. M. K. Salisbury is vice-president; Mr. William M. Rees is secretary. The managing director of the company is Mr. James Dietrick. He will place the contracts. Offices have been opened in the Park Row Building, New York, in order to facilitate purchases. The company intends to conduct mining operations on a scale hitherto unattempted in Central America. The concession is over an area of country not less than 40,000,000 acres. There is an abundance of water power available. Everything, more or less, about the mines will be operated by electricity, and it is estimated that at least $3,000,000 will be expended in the equipment. The managing director of the company is the same Mr. Dietrick who some three years ago bought about $750,000 worth of Yankee machinery, including electrically-operated dredges, for use in Mongolian and Manchurian mines worked by Russian interests.

EQUIPMENT FOR ITALIAN IRON PLANT.—Contracts are about to be placed in this country for equipment in an extensive iron plant to be built in northern Italy. The machinery will be electrically operated. The placing of the contracts is in the hands of Mr. A. M. Cristoffanini, via Garibaldi, 18, Genoa. He is now inquiring in this market for about 500 hp of motors varying in capacity from 6-hp to 25-hp. He will also purchase about a dozen electric traveling cranes, varying from 3 tons to 10 tons capacity. The following is a detailed list of the various machinery to be installed: One plate-bending roll machine with three rolls, to be operated by three motors, 10 hp, 10 hp and 25 hp; one plate-bending roll machine with four rolls to be driven by 20-hp and 5-hp motors; another plate-bending roll machine with three rolls to be operated by a 20-hp motor; one angle iron bending power machine with four rolls to have a 15-hp motor; a planing machine to be driven by a 10-hp motor; a punching cutting machine with a 6-hp motor; two lathes to be worked by 7½-hp and 10-hp motors respectively. The overhead traveling crane equipment will consist of two machines of 5 tons capacity with three motors each; another of 3 tons capacity to have a similar number of motors; five cranes of 4 tons each to have three motors each, and one 10-ton crane, also to have three motors.

SOME CROCKER-WHEELER ORDERS.—The Crocker-Wheeler Company, through its New York offices in the Taylor Building, of which Mr. F. B. DeGress is general manager, has secured an order from the W. A. Clark Wire Company, of Bayway, N. J., for a 150-kw, 125-volt engine type generator for direct connection to a Ball & Wood engine. This equipment will be used for power in the Bayway plant controlled by Senator W. A. Clark, of Montana. Preston Brothers, the electrical contractors of Norwich, Conn., who represent the Crocker-Wheeler Company in that section, have placed an order for generating equipment, etc., for installation in the printing plant of the *Norwich Bulletin*. There will be two 10-kw Crocker-Wheeler generators direct-connected to Shepherd engines. There will be 15 motor equipments used for driving the printing presses. The motors will range in capacity from ½-hp to 10-hp each. A 50-kw Crocker-Wheeler engine-type generator will also be put in the lighting plant of the Hospital for the Insane at Norwich. The generator will be direct-connected to a Harrisburg engine.

EQUIPMENT FOR ROCHESTER, N. Y.—Mackenzie, Quarrier & Ferguson, 114 Liberty Street, have just closed a number of contracts for equipment to be installed in Rochester, N. Y., plants. Three 150-hp Harrisburg simple engines are to serve in the electric light and power plant to be built by Burke, Fitzsimons, Hone & Company for their big department stores. The generators have not yet been ordered. Three 75-hp Harrisburg simple engines, direct-connected to 3-wire, 125-250-volt General Electric generators of 50-kw capacity each are to go in the new Cutler Building. The county of Munroe building is to have a 75-hp Harrisburg simple engine direct-connected to a Westinghouse 50-kw generator for lighting. In New York City an order for a 150-hp Harrisburg simple engine to be direct-connected to a 100-kw General Electric generator has been secured from Lord & Taylor.

PROPOSED NEW YORK ELECTRICAL EXPOSITION.—It is proposed to hold an International Electrical Exposition at Madison Square Garden, New York City, December 19 to 28, under the management of Messrs. Weber and Rush, and Mr. Max Spiegel, business representative. Their address is the Knickerbocker Theatre Building, Broadway. Though not known in the electrical field, they are prominent in theatrical and show enterprises. It is understood that a price of $1 per foot of space will be charged, and for current one-half and one-quarter cent per 16-cp lamp hour. The admission price is put at 50 cents. With every 20 feet of space rented is given a coupon book containing four admissions for each day of the exhibition, for exhibitors and employees. There is an idea that many exhibitors who did not go to St. Louis may wish to avail themselves of this opportunity.

POWER FOR PROCTOR, VT.—Important improvements at the Vermont Marble Company's plant have been started in preparations now under way for the erection of a 3,600-hp electric plant with which the company's works in this section will be run. The cost of installing this modern equipment will go into hundreds of thousands of dollars. The contract for the electrical apparatus alone amounts to nearly $100,000. The preliminary work, which will be erected at Sutherland Falls, in Proctor, has already been begun, and it is planned to have the power plant in operation next spring. The contract has been given the General Electric Company for three 1,200-hp generators. Another contract has been placed with I. P. Morris Company, of Philadelphia, for three water wheels of 1,200-hp each, to be placed at the falls in the Otter Creek in the rear of the plant in Proctor.

SOME C. & C. ORDERS.—The C. & C. Electric Company, of 143 Liberty Street, reports that the motor business, especially in small machines, has shown signs of considerable improvement within the past few days. The Ohio Quarries Company, of North Amherst, O., which has already in operation upward of 600 hp of C. & C. motors, has just contracted for two 125-hp machines and one of 60-hp capacity. These motors will be used for the purpose of driving stone-hoisting machinery. The Standard Electric Company, of New Orleans, La., has placed an order for a C. & C. generator rated at 75 kw for additional lighting purposes in the city of Lafayette, La., plant. The generator will be direct-connected to an engine to be built by the Chuse Manufacturing Company, of Matoon, Ill.

DODGE & DAY, engineers, Philadelphia, have completed their plans and specifications for extension to the plant of the Victor Talking Machine Company. They contemplate the use of 600 hp horizontal tubular boilers, four units each 18 inches long by 72 inches in diameter, with a working pressure of 125 pounds; natural draft; two horizontal, automatic, high-speed engines, 160 and 240 hp respectively, direct-connected to a 100 and 150-kw generator; 15 electric motors ranging from 5 hp to 75 hp; two elevators; heating system; fire, feed-water and vacuum pumps; switchboard and wiring; sprinkler system; water tanks, etc.

THE INTERNATIONAL TELEPHONE MANUFACTURING COMPANY, of Chicago, recently consigned to the town of Neepawa, Manitoba, a complete new exchange equipment, together with all necessary construction material, lead covered cables, etc., for completely reconstructing and extending the local system. In common with the policy adopted by many Canadian cities and towns, the new plant will be controlled and operated by the municipality. The International, by the way, has thus far furnished the equipment for practically all of the "Independent" exchanges in the Canadian provinces.

NATIONAL WIRE PLANT.—The National Wire Corporation is about to increase its manufacturing facilities and has just ordered from the Crocker-Wheeler Company a 400-kw engine type generator to be direct-connected to a Corliss engine about 700-hp capacity made by the C. & G. Cooper Company. Several more motors will also be installed, the contract for which is expected to be placed within the next two weeks. The Crocker-Wheeler people have already put in about 700 hp of motors in the New Haven plant.

EQUIPMENT FOR BALTIMORE TWINE PLANT.—The W. & J. Knox Net & Twine Company, of Baltimore, Md., has ordered a 10-kw generator and eight motors, one of 10-hp and seven of 15-hp capacity each, from the Crocker-Wheeler Company. The generator will be direct-connected to a Harrisburg standard engine of 150-hp capacity, the order for which was secured by MacKenzie, Quarrier & Ferguson, of 114 Liberty Street.

LIGHTING PLANT FOR JALISCO.—Mexican advices state that Porfirio Torres Camarenas, of Guadalajara, has secured permission from the State authorities for the construction and operation of an electric lighting plant at Arandas, a town of some 4,000 inhabitants, in the State of Jalisco. Steam power will be utilized.

BIG NEWARK STORE TO TAKE STREET CURRENT.—Scheuer & Company, which concern is to build a large department store in Newark, N. J., will take the necessary electric current from the street. Mr. B. S. Harrison, of 106 Wall Street, is acting as consulting engineer in the matter.

LARGE PLANT FOR ESTES PARK.—A big plant is to be installed for the purpose of generating energy for light and power at Estes Park, the Colorado resort. Mr. C. O. Mailloux has been retained to act as consulting expert on the work.

General News.

THE TELEPHONE.

GREENVILLE, ALA.—Dr. C. J. Watson, of Georgiana, will put in a telephone exchange.

HUNTSVILLE, ALA.—Several farmers in the southern part of Madison County have organized an independent telephone company with a capital stock of $2000, for the purpose of installing telephones in the homes of members and connecting the exchange with this city.

PINE BLUFF, ARK.—The Southwestern Telegraph & Telephone Company will spend about $75,000 in improving its service at Pine Bluff, including the placing of its wires underground.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed with the County Clerk by the Direct Line Telephone Company with a capital stock of $1,000,000. The move is merely the reincorporation of the Automatic Direct Line Company, having a system of house telephones in operation in the city, and the purpose of the reincorporation is to enlarge the scope of the business and increase the capital stock, which was $250,000. There are 25 subscribers to the new issue, aggregating $118,800. The purpose is to eventually make connections with all cities and towns on the Pacific Coast. The directors are A. K. Andriano, of San Francisco, who is the largest subscriber, C. F. Runyon, Julius Fay, Robert Capelle, George W. Emmons, Joseph A. Stultz and William B. Pringle.

ABBEVILLE, GA.—The Bell Telephone Company is erecting poles for the extension of its long distance lines into Abbeville.

PITTSFIELD, ILL.—The County Telephone Company has increased its capital from $50,000 to $75,000.

CRESTON, ILL.—The Tri-County Telephone Company has voted to increase its capital stock to $5000.

TUSCOLA, ILL.—The Tuscola Telephone Company has increased its capitalization from $5000 to $10,000.

CEDARVILLE, ILL.—The Cedarville & Stephenson County Telephone Company has been formed, capital $7000. Incorporators: S. W. Roberts, H. M. Fisk and others.

SHELBYVILLE, ILL.—The Rose Township Mutual Telephone Company has been formed, capital $1020. Incorporators: Philip Roessler, George Ruff and Jacob Kull.

BELVIDERE, ILL.—The Boone County Rural Telephone Company has been incorporated with a capital stock of $25,000. Fred W. Plane, D. W. Barningham and H. S. Hicks are the incorporators.

EDWARDSVILLE, ILL.—Articles of incorporation of the Troy Telephone Company have been filed. The capital stock is $10,000. The incorporators and principal stockholders are J. W. Gornet and Chris Busse, Jr.

PEORIA, ILL.—The Central Union Telephone Company in Peoria will improve its system, expending about $80,000. Nine miles of aerial cables, four stretches of underground conduits and five miles of new poles are part of the improvement.

UPPER ALTON, ILL.—The Upper Alton Village Board has granted a franchise to a new telephone and telegraph company composed of farmers who are building a farmers' telephone line from Fosterburg, and desire to connect with the Kinloch and Bell companies in Upper Alton.

SUBLETTE, ILL.—Geo. Fluehr and W. Brown have taken the contract to set up a new telephone line northeast of this village for a distance of about seven or eight miles. The new line will be for the accommodation of the farmers northeast of here and will be connected with the Lee County Telephone central.

CHICAGO, ILL.—The building and grounds committee has received a recommendation from Superintendent Cooley and Business Manager Guilford that a public school telephone system be installed. The estimated cost of installing the system is $40,597. If the police wires and operators are used the cost would be reduced to $30,000.

FRANKLIN, IND.—The Farmers & Citizens' Telephone Company has been formed, capital stock $10,000.

MAUCHPORT, IND.—The Eureka Telephone Company has increased its capital from $10,000 to $25,000. Edward F. Wendell is president.

BROWNSVILLE, IND.—The Brownsville Co-operative Telephone Company notifies an increase in capital stock from $2000 to $5000. W. H. Hawkins is president.

WILMOT, IND.—The Wilmot Mutual Telephone Company has been incorporated with a capital stock of $10,000, by L. R. Gerard, J. W. C. Scott and H. T. Kline. See Cromwell item.

URBANA, IND.—The Urbana Independent Telephone Company has been incorporated with a capital stock of $10,000 by Adam Cook, George Pretorius, J. C. Schmalzreid.

PERU, IND.—The Peru Home Telephone Company held its annual election with the following result: President, L. B. Fulwiler; vice-president, Jerome Herff; secretary, Dr. W. A. Huff; treasurer, Joseph Bergman; manager, Dr. J. E. Yarling.

EVANSVILLE, IND.—The Cumberland Telephone and Telegraph Company has petitioned for a franchise in this city, offering $100,000, to dismiss the suit now pending and to pay all costs of litigation, if granted the privileges for which the petition asks.

CROMWELL, IND.—The Etna Telephone Company has changed its name to Wilmot Mutual Telephone Company. The officers of the new organization are H. T. Kline, president; Geo. S. Bause, vice-president; L. R. Gerard, secretary and treasurer. The new company is capitalized at $10,000.

LOSANTVILLE, IND.—A. L. Cox was to turn over to the Parker City Telephone Company the plant which he owns here on Aug. 1, consideration being $1200 cash and stock in the Parker City Company. The Cambridge City Telephone Company, through its representative here, G. W. Lamb, has built into Economy, thus giving that town three telephone lines.

ANDERSON, IND.—The rebuilding of the plant of the Central Union Telephone Company is approaching completion. Active work on new toll lines is going on and Markleville, Pendleton and Linwood will shortly be connected with Anderson by new lines. The total cost of the improvements will reach about $30,000 and about 40,000 miles of wire will have been added when the work is finished.

WEBSTER CITY, IA.—The Martin Telephone Company of this city has served notice of a suit for $1000 damages against the Stratford Independent Telephone Company; $500 damages is alleged to be due on a breach of contract and $500 exemplary damages claimed.

FORT DODGE, IA.—A mortgage for $1,500,000 by the Northwestern Telegraph Company to the Bowling Green Trust Company has been filed in the office of the county recorder. The instrument is known as a four and one-half per cent. funding thirty-year gold bonds mortgage. The Northwestern Telegraph Company's lines are held by the Western Union Telegraph Company under a ninety-nine year lease.

ELSMORE, KAN.—The Katy Telephone Company has been formed with $2800 capital stock.

GALENA, KAN.—The Galena Home Telephone Company has been incorporated with $10,000 capital stock.

ANN ARBOR, MICH.—The Washtenaw Home Telephone Company, which is an independent company, has opened up connections with Jackson and will thus gain access to the western part of the State.

MERRICE, MICH.—A new telephone company, capitalized at $1000, and operating throughout Antrim and Conway, has been organized with the following officers: President, Louis Hall; secretary, N. H. Blake; treasurer, Moses Fuller; board of managers, Louis Hall, N. H. Blake and Moses Fuller.

MUSKEGON, MICH.—At the annual meeting of the Citizens' Telephone Company reports submitted showed that the company had closed the most prosperous year in its history. A semiannual dividend of 4 per cent., payable July 20, on the capital stock of $50,000 was declared and the old board of directors and officers was re-elected. President, Thomas Hume; vice-president, Dr. B. D. King; treasurer, L. B. Smith; secretary, W. H. Mann; manager, William Robinson.

BENTON HARBOR, MICH.—The Twin City Telephone Company and the Michigan State Telephone Company are now no longer competitors, but having reached an adjustment the St. Joseph River is now the dividing line between the two telephone systems. The fact that the Michigan Telephone Company was about to expend $75,000 for the Benton Harbor division would only have strengthened the fight that has been on for the past seven years. The Twin City Telephone Company has accordingly sold to the old Bell system everything across the river, which means not only St. Joseph but Berrien Springs and all neighboring villages. All patrons across the river will hereafter be on the Bell system. The Twin City's line touching South Haven, Coloma and all points on this side of the river is retained.

WADENA, MINN.—The local telephone exchange is to be rebuilt.

RUTLAND, MINN.—The local farmers have organized a company and will install a telephone system.

WINONA, MINN.—The start to secure an underground conduit system for telephone wires has been made by the Northwestern Company.

ATWATER, MINN.—The Harrison Union Telephone Company is building a toll line to New London. The same company proposes to build a metallic circuit from Spicer to Willmar.

MORTON, MINN.—Articles of incorporation have been filed with the Secretary of State by the Morton Rural Telephone Company, of Morton, with a capital of $25,000. The incorporators are F. W. Orth, F. W. Penhall, M. J. Egan, Fred Watschke, George Welsh, R. B. Henton and Henry Beckman.

ST. LOUIS, MO.—The St. Louis County Telephone Company has closed a contract for 500 automatic telephone call boxes, 50 of which are to be delivered immediately, and an appropriation of $3000 has been authorized for the purchase of poles. The company will shortly begin the work of constructing trunk lines from Clayton to Webster Groves and Kirkwood.

ST. JOSEPH, MO.—Improvements and extensions in the equipment of the Missouri & Kansas Telephone Company, now in progress of construction, will result by the close of the present year in the expenditure of large sums of money in the construction of new lines in the city and in the installation of a new office equipment at a cost of more than $100,000. There will be $15,000 expended in the construction of new lines.

RED LODGE, MONT.—On account of their refusal to permit the Rocky Mountain Bell Telephone Company to place poles and string wires in accordance with a decision of the Supreme Court, the Mayor and City Council of this city have been cited to appear before the court and show cause why they should not be punished for contempt. A bitter fight has been made by some of the members against the proposed operations of the telephone company.

NELSON, NEB.—The Nuckolls County Independent Telephone Company has been incorporated with a capital of $25,000.

ELGIN, NEB.—The Antelope County Mutual Telephone Company, of Elgin, Neb., has been incorporated with a capital stock of $60,000 and a paid up capital of $1500.

OMAHA, NEB.—Active measures have been taken for the first time before the City Council by the independent telephone companies to secure a franchise in Omaha. The new company asks for a franchise to use the streets and alleys for twenty-five years. Plans and specifications will be filed immediately after the franchise is granted and work is to begin within three months. Within

twelve months an exchange of 2500 subscribers will be built. All wires are to be underground from Clark to Leavenworth Streets and from the river back to Twenty-eighth Street, except the distributing wires for each block.

CHENANGO, N. Y.—The Castle Creek & Chenango Telephone Company has been incorporated, capital $500, by J. M. Brooks and others.

BINGHAMTON, N. Y.—The Sherman & Hale Eddy Telephone Company has been formed with $700 capital, by C. H. Siles, H. Eddy and others.

CHERRY CREEK, N. Y.—The Conewango Valley Telephone Company, which was recently incorporated with a capital stock of $10,000, has elected officers as follows: President, J. W. French; vice-president, B. W. Rood; secretary, E. J. Helmick; treasurer, H. S. Sweetland; general manager, C. G. Mead. The company is working on the establishment of a first-class local telephone exchange with long distance service. The territory includes a number of prosperous towns such as Cherry Creek, Dayton, Hamlet, Conewango Valley, Millville, Markhams and Wright's Corners.

WHEATLAND, N. D.—A new telephone exchange is being installed.

CHRISTINE, N. DAK.—The Eagle Telephone Company is extending its line. The Neighbor State Telephone Company will build a line from here to Walcott.

CARDINGTON, OHIO.—The Morrow County Telephone Company is extending its lines.

DAYTON, OHIO.—The Home Telephone Company has increased its capital to $1,000,000.

FRANKLIN, OHIO.—The Franklin Telephone Company has increased its capital stock to $5000.

COLUMBUS, OHIO.—The Girard Telephone Company has been incorporated with $35,000 capital by E. H. Lotze and others.

YOUNGSTOWN, OHIO.—The Youngstown Telephone Company has increased its capital stock from $200,000 to $400,000.

FOSTORIA, OHIO.—The West Millgrove Telephone Company has been formed by W. W. Rosendale, J. P. DeWolfe and others. Capital stock, $3000.

SALEM, OHIO.—The Salem Township Rural Telephone Company, $2000 capital stock, has filed articles of incorporation with the Secretary of State. H. A. Halverstadt, E. P. Aldridge, Homer Halverstadt, E. H. Simon, H. V. Zimmerman and D. W. Brinker are the incorporators.

NEWARK, OHIO.—The Newark Independent Telephone Company has just entered into a contract for the exchange of business with the new Gratiot & Brownsville Telephone Company, which will connect several towns in the southern part of Licking County. Work on the line from Newark to Brownsville has begun.

TYRON, OKLA.—The Lincoln County Rural Telephone Company has been formed with a capital stock of $5000. Incorporators are Wm. Teegarden, T. D. Rush, G. W. Howerton, A. G. Walters and J. N. Smith.

WASHINGTON COUNTY, PA.—The Farmers' Mutual Telephone Company has been formed with $30,000 capital. Directors: C. M. Linn, J. R. McPherson and others.

PITTSBURG, PA.—Officials of the Pittsburg & Allegheny Telephone Company have plans on foot for the connection of every independent telephone plant within a radius of 100 miles of Pittsburg with a long distance service during the next three months. As a result of the plans which are now in contemplation several lines, some of which are practically completed, will be opened, extending the service to Butler, Johnstown, Wheeling and other portions of western Pennsylvania and West Virginia, while it is the intention to extend the northeastern lines to Buffalo and Syracuse. Application will be made to the Governor on August 22 for a charter for the Pittsburg-Butler Telephone Company, through the establishment of which it is proposed to provide a long distance service to Butler and the adjoining neighborhood. The rights of way for the route have been obtained by the company, and it is said that it will be possible to have the line in operation within a month after the charter has been obtained. The applicants for the charter are J. G. Splane, president of the Pittsburg & Allegheny Telephone Company; John S. Weller, general counsel for the company, and T. J. Shufflin. The new line will be a standard metallic circuit route, having about five circuits.

HUNTINGDON, TENN.—The Consolidated Telephone & Telegraph Company has been incorporated, with $50,000 capital, by T. S. Hughes and others.

McKENZIE, TENN.—The Consolidated Telephone & Telegraph Company has been granted a charter with a capital stock of $50,000, to do business in this and several river counties.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company has been making experiments on the great Mormon Tabernacle organ, by which it expects to enable people throughout the West to hear by telephone concerts frequently held there.

RICHMOND, VA.—The Damascus Telephone Association of Washington County has been incorporated with a capital stock of $2000.

BELLAIRE, W. VA.—A franchise has been applied for here by the Ohio Valley Telephone Company.

PRATT, WIS.—The Home Telephone Company, of Ashland, is putting in a toll line from Ashland to Pratt.

SHAWANO, WIS.—The Farmers' Independent Telephone Association has increased its capital stock $2500.

CAMBRIA, WIS.—The Cambria Co-operative Telephone Company has been formed with $1500 capital stock by E. Ford and others.

GREEN BAY, WIS.—The Wisconsin Telephone Company has started work on a $50,000 exchange building and underground system at Green Bay.

MILWAUKEE, WIS.—The Union Grove & Paris Telephone Company has been formed, capital $2000. Incorporators: Henry Baens, O. T. Graham and C. E. Barholf.

CAMBRIA, WIS.—The Cambria Co-operative Telephone Company, Cambria, Columbia County, has been formed with a capital stock of $1500. Incorporators: H. W. Thomas, Chris Hecker, E. D. Ford and sixteen others.

LA CROSSE, WIS.—The La Crosse Interurban Telephone Company has closed the purchase of the Barre Mills telephone line. This adds over one hundred subscribers to its lines. The company now has exclusive connections with the farmers' lines in Barre Mills circuit and Bostwick Valley district.

TWO RIVERS, WIS.—The Twin River lighthouse will be connected with a telephone system before a great while. The need of telephonic communication between the lighthouse and the lifesaving station has been felt for a long time, owing to the fact that disasters are frequently witnessed there, and by having a telephone system, the warning for help could be communicated to the lifesaving station at once.

ELECTRIC LIGHT AND POWER.

REDDING, CAL.—The Northern California Power Company has just put a second power plant in operation in Shasta County. The company had one plant in the Shingletown region of a capacity of 4000 horse-power, but it was found insufficient for growing needs, so the second plant was built on Cow Creek, near Whitmore, having a capacity of 5000 horse-power.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Company is to install forty new arc lamps at various places in the southern portion of the city. The new lamps will be of the inclosed type, and each one will be hung on a bracket about four feet from the pole, so that there will be a minimum of shadow. The expense of renewing the system will be $50,000.

NEW LONDON, CONN.—The Groton Water & Electric Company will increase its facilities at the power house and pumping station at Poquonoc by the installation of a 250-hp steam engine.

NORFOLK, CONN.—At a meeting of the Norfolk Electric Light & Power Company a proposition was made by parties in Canaan to lease the lighting plant of the local company for thirty years. If the details can be satisfactorily arranged it is probable that the proposition will be accepted.

DOUGLAS, GA.—Bonds to the amount of $20,000 have been sold, to be used for the construction of water works and an electric light plant.

EDINBURG, ILL.—The Edinburg Light, Heat & Power Company has been incorporated, with a capital of $30,000, to operate light, heat, power and water plants. J. R. Harrington, L. E. Swigert and Reuben Wilkinson are the incorporators.

MONTPELUR, IDA.—A new electric light plant is in course of construction.

MOSCOW, IDAHO.—The Moscow Electric Light & Power Company proposes to run a transmission line to Pullman and Washington.

EAST ST. LOUIS, ILL.—The Illinois Illuminating Company, of East St. Louis, has been incorporated by C. E. Harris, George F. McNulty and E. G. Bruckmann, with a capital of $50,000, to furnish light, heat and power for East St. Louis and St. Clair and Madison Counties.

EAST ST. LOUIS, ILL.—Articles of incorporation of the Illinois Illuminating Company have been filed. The corporation is to furnish light, heat and power for East St. Louis, St. Clair and Madison counties. It is capitalized at $50,000 and C. E. Harris, Geo. F. McNulty and E. G. Bruckmann are the incorporators.

ALEXANDRIA, IND.—The City Council has contracted with the Alexandria Electric Light & Power Company for street lighting for ten years.

SOUTH BEND, IND.—The Economy Electric Corporation has been formed, capital stock $10,000. Directors: Ulysses S. Meeks, Cora M. Meeks, William F. Wood and Blanche D. Wood.

LOGANSPORT, IND.—Denis Uhl and others will construct a large electric power plant in Logansport, to cost $150,000. The plant will be operated by water power, necessitating the construction of a dam in Eel River.

RICHMOND, IND.—The Light, Heat & Power Company has made a proposition to continue to light the city after its contract expires next September. The old company claims it can furnish the city with light at a price lower than it will cost the municipal plant to produce it. It is generally believed the city will not consider the proposition, as the municipal plant is making arrangements to light the city at the expiration of the present contract.

WILTON JUNCTION, IOWA.—The Electric Construction & Machinery Company, of Rock Island, Ill., has secured the contract for improvements in the electric light plant at Wilton Junction, for $5,491. Prof. G. W. Bissell, of Ames, is engineer.

EMPORIA, KAN.—W. O. Johnson, of Winfield, proposes to establish a $20,000 electric plant at Emporia

NESS CITY, KAN.—The Ness City Electric Light Company contemplates the erection of a power plant in connection with an ice plant.

HOPKINSVILLE, KY.—The Hopkinsville Gas Light & Power Company has been reorganized under the name of Hopkinsville Gas & Electric Company, and articles of incorporation filed. The capital stock is $25,000, divided into $15,000 preferred stock bearing 5 per cent. interest and $10,000 common stock. The incorporators are Messrs. W. T. Tandy and James A. Young, Jr., of Hopkinsville, and W. C. White, of Cadiz.

PROVIDENCE, LA.—The town proposes to issue bonds for a water and electric light plant.

BROOKLYN, N. Y.—The New York & New Jersey Telephone Company has completed the laying of its ducts for underground cables from Hempstead to Farmingdale, and now has a continuous line of subways for its main cables from Brooklyn to Farmingdale. The wire cables will be drawn through the ducts soon and when that is done all of the lateral lines from Babylon, Amityville, Freeport, Northport, Huntington, Oyster Bay, Glen Cove and other north and south side villages will be feeders for the cable line.

SALISBURY, MD.—The incorporators of the Wicomico Electric Power Company met in Salisbury and organized. The officers are Thomas Perry, president; Charles R. Disharoon, vice-president; W. S. Gordy, Jr., secretary; H. L. Brewington, treasurer; W. J. Staton, James T. Truitt, E. A. Toadcine, M. A. Humphreys, J. D. Price, Dr. Samuel L. Graham, of Salisbury. The charter granted at the last session of the Legislature was very liberal, the limit of capitalization being $2,000,000.

HUDSON, MASS.—The Municipal Light & Power Plant will furnish electricity for motive power after September 1.

HAVERHILL, MASS.—A 300-hp engine has been installed in the Charlesworth power plant, which furnishes current for nearly all the factories on Washington Street.

BEVERLY, MASS.—The Beverly Gas & Electric Company has been making additions to its already well-equipped station. Three new 150-kw, alternating-current generators and a new marble switchboard are among the improvements.

LENOX, MASS.—A meeting of the Lenox Electric Company has been held and the following list of officers was elected for the coming year: President, William D. Curtis; vice-president, Henry Sedgwick; clerk, William G. Clifford; treasurer and water commissioner, Isaac J. Newton.

TURNERS FALLS, MASS.—The Franklin Electric Light Company elected these officers at the annual meeting: President, J. F. Bartlett; clerk, E. I. Cassidy; treasurer, W. C. D. Thomas. Directors—Porter Farwell, C. W. Hazelton, H. D. Bardwell, W. D. Russell. Within a year the company will be able to obtain power from the Turners Falls company and will then be in a position to greatly extend its system in the village.

WINNIPEG, MAN., is to secure electric power, transmitted from the lower Winnipeg River, to the north. A company with a capital of $5,000,000 has been formed. The officers are H. J. McDonald, former premier of the province, president; Daniel McMillan, governor of Manitoba, vice-president, and R. P. Roblin, the present premier, secretary and treasurer. This company states that it expects to have power into the city in two years and to deliver it to manufacturers at half the present cost of steam. About $100,000 has already been spent in development and engineering. The power will be transmitted forty miles.

RENO, NEV.—The Electric Light Company has been incorporated with a capital of $50,000, by G. H. Taylor, C. E. Horton and others.

LOCKPORT, N. Y.—The American District Steam Company has petitioned the common council for a franchise to operate a system for supplying electricity for light, power, heating and refrigerating purposes.

TAUGHANNOCK, N. Y.—The new power plant being built by the Ulysses Electric Light & Power Company at Taughannock Falls, under the direction of Mr. Gardner S. Williams, is rapidly approaching completion and the work is being pushed with the utmost vigor. With this new source of power it is expected to furnish electric service to the towns of Trumansburg, Jacksonville, Taughannock, Interlaken and all intervening points.

ALBANY, N. Y.—The Central Power & Manufacturing Company, of this city, has filed a certificate of incorporation. The company proposes to manufacture electricity for light, heat and power purposes. The capital stock is $10,000, and the directors are Charles R. Huntley, William R. Huntley and D. T. Nash, all of Buffalo. The company will operate in the counties of Schenectady, Saratoga, Albany and Rensselaer, the cities of Schenectady, Cohoes, Watervliet, Troy and Albany and the towns of Glenville, Rotterdam and Niskyuna, Schenectady county; Clifton Park, Half Moon, and Waterford, Saratoga County; North Greenbush, Rensselaer County.

CHARLOTTE, N. C.—The Raeford Electric Power Company has been formed with $200,000 capital.

XENIA, OHIO.—The Xenia Heat, Light & Power Company will prepare plans for a central heating and electric light plant.

BUCYRUS, OHIO.—Jas. Finley, of Pontiac, Mich., is stated to have purchased the plant of the Bucyrus Gas & Electric Light Company and will make improvements to the same.

VERSAILLES, OHIO.—The municipal electric lighting plant will require about 500 feet of insulated cable, probably two direct-connected generators and one vacuum pump for water works.

ZANESVILLE, OHIO.—The City Council has passed the ordinance granting a five-year franchise to the Southeastern Ohio Railway, Light & Power Company to erect poles and string and maintain lines of wire for conducting electricity to be used for heat, light and power.

GUTHRIE, OKLA.—A charter has been issued to the LeClair Electric Company, with its principal place of business at Oklahoma City, for twenty years and a capital stock of $10,000. The incorporators are L. A. LeClair, B. F. Leggett and Chas. Edward Johnson.

NEWBERG, ORE.—The proprietor of the electric lighting plant, C. I. Edwards, is increasing its capacity.

ALLEGHENY, PA.—The Council has passed an ordinance providing for the purchase of a 120-arc light dynamo and 125 enclosed arc lamps.

SEWARD, PA.—The Seward Heat, Light & Power Company, of Seward, has been incorporated with a capital of $5,000. Directors: D. B. Anderson, Alex. Kerr and Bert Wagner, of Seward.

COATESVILLE, PA.—The Consumers' Electric Light, Heat & Power Company expects to have its new plant ready to start up by September 1.

LORETTA, PA.—The Council has under consideration a proposition from Charles M. Schwab to construct water works, a sewerage system and an electric light plant as a present to the community.

WILLIAMSPORT, PA.—The contract for lighting streets and engine houses for ten years has been awarded to the Lycoming Electric Company, of Williamsport, for 221 arc lights, $60 per light, and $18 per light per year for incandescent lights, and for lights in engines houses and city hall, 10 cents net per kw hour.

SHENANDOAH, PA.—The People's Light, Heat & Power Company, of Mahanoy City and Shenandoah, has purchased the ground and the title of the lease land owned by the Hooven Mercantile Company, situate on East Railroad Street, Mahanoy City. The consideration is not given. Work on the erection of the plant will begin at once, as most of the contracts were awarded several weeks ago. At the same time a force of men will be put to work erecting the line between that town and Shenandoah, taking in the surrounding places.

WESTERLY, R. I.—The People's Light, Heat & Power Company, of Westerly, R. I., which recently took over the Mystic Electric Light & Power Company, has completed arrangements for the absorption of other corporations. It has acquired the Pawcatuck Valley Street Railway Company, the South Shore Gas & Electric Company, and the Westerly & Hopkinton Railway Company. The Railway & Lighting Company now has a monopoly of the electric lighting business in the Rhode Island village of Westerly and the Connecticut villages of Pawcatuck, Stonington, Mystic, West Mystic and Noank. The corporation already has six miles of street railway in operation and 7½ miles in the course of construction.

NEWBERRY, S. C.—The commissioners of public works of Newberry have purchased the new electric lighting plant for the city. The purchase was made from the General Electric Company, Schenectady, N. Y. The new plant will be installed within the next few months. The purchase price of the new system was $5905.

KNOXVILLE, TENN.—Work will begin about September 1 on the plant of the Knoxville Power Company, which will be constructed on the head waters of the Little Tennessee by New York capitalists, and in which R. W. Austin, of Knoxville, is interested. The probable cost of the work is $100,000. Mr. John Bogart, of New York, is the chief engineer.

BROWNWOOD, TEX.—The Boysen Light & Power Company will be in the market later on for a 150-kw alternator and Corliss engine.

ARLINGTON, TEX.—The Arlington Light & Power Company has been incorporated, with a capital of $10,000, to own and operate an electric light and power plant. Incorporators: A. W. Collins, William Dugan, W. L. Sweet, E. A. Hood and W. Weeks.

SAN ANGELO, TEX.—The Concho Water Power Company has just completed a large wing dam on the South Concho River. The dam, which is built of stone and concrete, has cost in the vicinity of $2,500. The total length of both wings is 500 feet. This gives a spillway of twice the width of the river. A mill race 700 feet long leads to three turbine wheels. These will supply power for lighting the city and for pumping the city's water supply.

MONTPELIER, VT.—A new 200-hp generator is being put in at the Pioneer steam plant of the Consolidated Lighting Company to run the Barre & Montpelier Street Railroad direct from the power station.

ST. ALBANS, VT.—Work on the dam and electric power station at Fairfax Falls is progressing steadily and there is now every reason to expect that the power will be brought to the city by September 1 at the latest.

FRONT ROYAL, VA.—The contract for electric light machinery, etc., has been awarded to Rumsey Electric Manufacturing Company, of Philadelphia, Pa., for $5,000.

MOUNDSVILLE, W. VA.—William Donley has been awarded the contract for the construction of the building for the Moundsville Electrical Company's plant on First Street. The plant will cost nearly $4000, and will be so constructed that additions may be made as the business of the company increases.

CHEWELAH, WASH.—D. Van Slyke and D. F. Strobeck have secured a franchise for an electric light plant and water works.

SPRING GREEN, WIS.—The Spring Green Electric Light plant contemplates new meters, transformers and No. 0000 wire to the amount of $1200.

APPLETON, WIS.—The Fox River Valley Gas & Electric Company's plants at Appleton, Neenah and Menasha have been sold to the Wisconsin Traction, Heat, Light & Power Company for $600,000, the latter to assume control about Aug. 1. The plants originally cost $200,000, or about one-third of what they sold for. The deal gives them complete control of the lighting facilities of Appleton and the twin cities.

LADYSMITH, B. C.—Jos. Hunter, of Victoria, B. C., is reported interested in the construction of an electric light plant.

LONDON, ENG.—The big contract for electric equipment to be installed in the power plant of the municipality of Marylebone, a northwest suburb of London, has been allotted to a British concern—C. A. Parsons & Company, Newcastle-on-Tyne. Parsons turbines will be installed. The accepted contract price was £79,598. The cables will also be of British manufacture—W. T. Henley Telegraph Works Company secured the contract. The price is £96,860.

OMAHA, NEB.—Chicago capitalists have organized a company to build and operate the first large interurban electric railway in the State of Nebraska. The project has been incorporated under the laws of the State of Nebraska, and will be known as the Omaha & Nebraska Central Electric Railway. It will be 200 miles long and will extend from Omaha to South Omaha and in a westerly direction through Millard, Wahoo, David City, Osceola, Stromberg, Arborville, Aurora and Hastings. The road will carry passengers, mail and freight, and be constructed of standard gauge. It will be equipped with high-speed cars of modern construction, 65 feet long, and there will be a lighting, telegraph and telephone service in connection with it. Work on the road will begin immediately, and it will be completed and in operation within a year.

KINCARDINE, ONT.—The citizens have voted to extend the water works and electric light plant, at a cost of $4,500.

THE ELECTRIC RAILWAY.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company is contemplating extending its Tuxedo line to Sherman Heights.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has begun work on its spur across the Wilmington Lagoon from Wilmington to San Pedro. The work progresses at the rate of about 230 ft. per day of trestling, and at this speed the trestle should be completed and ready for the track by Aug. 15. The trestle will be over a mile long.

WILMINGTON, DEL.—The right of way for the Delaware Suburban Railway Company from Wilmington to Elkton, Md., has been secured, and work will commence at once. The line will begin either at Fifth and Market or Fifth and King Streets, run out Fifth to Clayton, thence to the city line, and then via Marshallton and Newark to Elkton. Eventually it is intended to extend the line to Oxford, Pa., a further distance of 15 miles. The power house will be located near Newark. Ricketts Nelson, of Elkton, Md., is secretary.

CHICAGO, ILL.—The latest move in the war now being fought between the Graham & Morton steamer line and the Pere Marquette Railroad over passenger rates between Chicago and Michigan points is the announcement that the steamship line will shortly carry the fight into the enemy's country by the construction of an electric railway from St. Joseph, its Michigan lake-port, to Paw Paw Lake and Kalamazoo, connecting with another interurban line with Grand Rapids.

INDIANAPOLIS, IND.—The Tipton, Frankfort & Attica Traction Company has filed amended articles of association whereby the company is empowered to produce and supply electricity for light, heat and power.

PERU, IND.—A new electric line is being projected between Marion and Logansport by the way of this city, with Logansport and Fort Wayne capital back of the enterprise. J. W. Wilson, of Fort Wayne, and Herbert L. Mossrock, of Logansport, are said to be pushing the project, and were recently through here, going over the proposed route, planning for the line.

INDIANAPOLIS, IND.—The building of a freight station for the use of the interurban lines entering Indianapolis has been planned on a large scale, and work will proceed as soon as the Supreme Court disposes of the question involved in a suit pending to test the right to haul freight through the streets. President McGowan, of the Terminal Company, announced that the money had been set aside for that purpose.

FORT WAYNE, IND.—Arrangements are being perfected for a merger by which the union of traction interests will secure control of the entire electric light and power business of Fort Wayne, the city's traction lines and all of the interurban lines centering there. J. Levering Jones, of Philadelphia, is conducting the deal. The money for the sale of a light and power plant, $550,000, has been paid over. The company will build a large power plant, capable of lighting the city and of furnishing power for the city and parks and the interurban lines.

SOUTH BEND, IND.—At a recent meeting of the stockholders of the Chicago & Indiana Air Line Electric Railway Company the name of the corporation was changed to the Chicago, Lake Shore & South Bend Railway Company, and the capital stock was increased to $3,000,000, a bond issue of that amount being approved. Part of the line is now working and work on the remainder will be pushed. Officers elected were: President, F. B. Wagner; vice-president and general manager, J. B. Hanna; treasurer, Francis C. McMillen, who, with Henry W. Judd and Judge Charles M. Stone, are directors. All are of Cleveland. Cars will be capable of running 50 to 60 miles an hour.

RICHMOND, IND.—The prospectus just issued by the Columbus, Greensburg & Richmond Traction Company claims that it will be one of the finest equipped in the United States. Contracts for construction has been let to the Westinghouse Electric & Manufacturing Company, of Pittsburg. The company will operate over an entire private right of way, 60 ft. wide and 80 miles long, through Bartholomew, Decatur, Rush, Fayette, Union and Wayne Counties. The line will run from 4 to 18 miles from any competing trolley or steam road, through a very fertile country, touching numerous prosperous towns and cities, and affording access to at least four of the most beautiful and popular parks in Indiana. The officials are: President, A. K. Hollowell; vice-president, H. F. Holland; treasurer, William P. Meyer.

IOLA, KAN.—The Kansas Southern Electric Railway Company is about commencing work on a line from Iola to Humboldt.

CHANUTE, KAN.—The citizens of this place, the Commercial Club and others, are interested in a proposed electric line from Chanute to the new cement works, 8 miles out.

OWENSBORO, KY.—The Owensboro Street Railway has been sold to James H. Parrish, John G. Delker, of Owensboro; Yewell Rice, of Louisville, and A. S. Wilson, of Pinkneyville, Ill. The parties who sell their interests are R. S. Hughes, James H. Hickman, F. T. Gunther, Charles Brooker and Charles Bellair, of St. Louis. It is the purpose of the new company to extend its lines to Bon Harbor coal regions, a few miles below the city.

SPRINGFIELD, MASS.—The Springfield Street Railway has filed an acceptance of the amended franchise conditions of the new line from Indian Orchard to Chicopee Falls. The conditions provide for a 35-foot underpass beneath the Athol branch, and the erection of a waiting-room near the Ludlow bridge at the end of the Springfield company's line. The forfeit of $10,000, which the Aldermen asked at first, is not required. The line must be built within eighteen months of the granting of the franchise.

BENTON HARBOR, MICH.—Final arrangements have been completed for actual construction of two lines from this city. G. A. Mullins, of the Kalamazoo & Lake Shore Traction Company, will let the contract for the construction and equipment of the line at a cost of nearly $1,000,000. The electric road will connect this city with Kalamazoo through Coloma, Watervliet and Paw Paw Lake. J. G. McMichaels also announces that the last stretch of right of way has been secured for his road, from this city to Dowagiac and Sister Lakes, with a branch to Niles, and actual construction will commence within a short time.

ST. JOSEPH, MO.—A survey is now being made for the Des Moines, Albany & St. Joseph Electric Railway. This is the road in which F. S. Mordaunt, of Chicago, is interested.

ST. LOUIS, MO.—The St. Louis, Webster Groves & Valley Park Railroad Company, to which the franchise secured by the St. Louis, Kirkwood & Manchester Railroad Company was transferred, has made a deposit of $1,000 with the County Treasurer, a condition imposed by the court, to be complied with at the time of the beginning of the actual work of construction. The assignment of the old company's right to the new and the acceptance by the latter were also filed. The proposed line is to be built west from the city limits, near the Clayton Road, through Webster Groves and Kirkwood to Valley Park, and finally to Manchester.

CHICAGO, ILL.—The local transportation committee of the City Council has made a final proposition to the City Railway, which provides for extension of franchise of all lines for 20 years. For the first 13 years the railway shall pay to the city 5 per cent. of the gross receipts and for the remaining 7 years 10 per cent. This proposition is not likely to be accepted by the company.

ALBANY, N. Y.—The Buffalo & Southeastern Railway Company has been incorporated with a capital of $300,000, to operate a street surface railway line from the village of East Aurora to Buffalo, passing through Spring Brook and Ebenezer, a distance of 12 miles. The directors are Fay H. Ball, E. E. Henshaw, Densmore Pratt and James Cadzaw, of East Aurora T. S. Miller, B. J. Cole, J. B. Kennedy and O. R. Blair, of Buffalo, and J. L. Baker, of Ithaca.

LONG ISLAND CITY, N. Y.—Sufficient consents have been obtained from property owners on Thomson Avenue and the Hoffman Boulevard, in the town of Newtown, to permit the New York & Queens County Railway Company to lay its tracks over those highways in a continuous line from Long Island City to Jamaica. The company already has a franchise from Jackson Avenue over Thomson Avenue to the old Long Island City line and over Central Avenue to Calvary Cemetery, and has made application to the Board of Aldermen for a franchise from the Newtown line to Jamaica Village. This application will be taken up early in September, it is said, by the board, and as soon as it is granted the company is prepared to go ahead with its projected double-track road, which will furnish a direct line about 8 miles in length from the site of the proposed Queens Borough Hall and the Blackwells Island Bridge Plaza to Fulton Street, Jamaica. This line will traverse an entirely new section of Queens, all of it through a high and rolling country, much of it wooded, especially the Forest Park section, and all of it likely to be a choice and high-class residential district.

MOORESTOWN, N. J.—The Moorestown Rapid Transit Company, of Moorestown, has been organized. The trustees are Joseph Stokes, Joseph Lippincott, Israel Roberts, James L. Trimble, Albert C. Heulinks and William D. Lippincott, all of Moorestown. The company is to secure for the residents of Moorestown and vicinity improved trolley and train service between Moorestown and Camden.

ASBURY PARK, N. J.—Upon application by the Point Pleasant Traction Company the court has appointed William J. Harrison, of Lakewood, Mayor L. N. Van Note and Justice Albert Allen, of Point Pleasant, to constitute a board whose duty it will be to fix a value on the lands through which the trolley company intends to build its line to Lakewood, and through which the company could not otherwise secure the right of way. It is rumored that the Point Pleasant Trolley Company has combined with the Point Pleasant-Lakewood Company, and also with the newly revived scheme of some years ago to extend the Asbury Park Trolley down from Belmar to Point Pleasant. After the line is built from Lakewood to Trenton there will be a complete system extending from Pleasure Bay, north of Long Branch, to Philadelphia. Travelers can then go from Lakewood to either New York or Philadelphia by trolley.

CHARLOTTE, N. C.—There is talk of an electric railway between Winston-Salem, N. C., and Yadkinville, and the line, it is said, will doubtless be built.

TOLEDO, OHIO.—The Toledo Urban & Interurban Railway Company has awarded a contract to the American Bridge Company for material for a new bridge near Maumee which will cost about $100,000.

TOLEDO, OHIO.—A large force of graders has commenced work on the Toledo & Point Place Railway. About a mile of track has already been laid. It is expected that the line will be completed this fall.

SPRINGFIELD, OHIO.—The Springfield & Xenia Traction Company's property was to be sold at receiver's sale on Aug. 12. It is probable that the present stockholders will arrange to buy in the property.

ASHLAND, OHIO.—D. F. Brubaker, of Ashland, one of the chief promoters of the Mansfield & Eastern Railway, states that the promoters have succeeded in financing the proposition, and that work on the line from Mansfield to Ashland will start in the near future.

TOLEDO, OHIO.—Preliminary work is being done on the new Toledo, Ann Arbor & Detroit Railway, and in a short time construction work will start in earnest. An official of the company claims that the road will be in operation between Toledo and Ann Arbor by next spring.

STEUBENVILLE, OHIO.—It is stated that Guy Brothers, of Boston, and W. N. Coler & Co., of New York, have arranged for the financing of the Canton & Steubenville Traction Company, which is being promoted by H. H. Smith, T. H. Loomis and Elmer E. Francy, of Steubenville.

CINCINNATI, OHIO.—The Interurban Railway & Terminal Company has been granted a franchise to extend its line from the Madison road north of Blue Ash to Montgomery. The road will be built on private right of way, and will furnish a valuable feeder to the Rapid Railway diviston.

TOLEDO, OHIO.—A project promoted by Muncie, Ind., and Toledo people is for a traction line to run direct from Muncie to Toledo. The company will be known as the Muncie & Northwestern Traction Company, and James

Kautz and Edward Finn, of Toledo, are working on right of way and franchises along the route.

LORAIN, OHIO.—It is stated that the Cleveland & Southwestern Traction Company is planning to build a short spur line to South Lorain, in order to enable it to handle part of the business to and from the large steel plant and tube works located there. At present the traffic is handled exclusively by the Lorain Street Railway.

TOLEDO, OHIO.—Officials of the Toledo, Port Clinton & Lakeside Railway Company state that the line will be placed in operation to Port Clinton by Aug. 15. The bridge at Oak Harbor, which has been holding up the work, has been completed, and the electrical equipment for the Genoa power station is being installed. An extension of franchise has been secured at Port Clinton.

OKLAHOMA CITY, O. T.—The Oklahoma City Railway Company now has its engineering corps at work surveying the line for an extension of its West Main Street line west of Russell Avenue, south to Delmar Garden and east to connect with the present terminus of the Colcord Park line. This is only a part of the extension work contemplated for this year by the company.

TOLEDO, OHIO.—The village of Woodmere, Mich., has granted a franchise through the town to the Detroit, Monroe & Toledo Short Line Railway, which removes the last obstacle for the completion of the line into Detroit. At present the company maintains through service by transferring passengers to the Detroit United Railways at Trenton, but in the near future the interurban cars will run into the center of Detroit.

TOLEDO, OHIO.—Charles Thatcher and C. E. B. Lamson are the apparent heads of a company organized for the purpose of making a proposition to secure franchises on the streets of Toledo over a number of the routes now occupied by the Toledo Railway & Light Company. The promoters claim they will make a low fare proposition. Mayor Tom L. Johnson, of Cleveland, is believed to be identified with the new company, but the Toledo people assert he is not interested, although it is admitted that he has been consulted in the deal.

TOLEDO, OHIO.—Ellis Bartholomew, who for the past three years has been endeavoring to finance the Toledo, Columbus, Springfield & Cincinnati Railway, will try the co-operative plan of floating the company's securities. The company is capitalized at $10,000,000, and it is understood that $98,000 worth of stock has been sold. The company is now endeavoring to interest the various towns on the route in an effort to sell stock to secure the sale of five-year bonds. About 12 miles of road has been graded, and poles and ties are down for 3 miles.

MORRIS RUN, PA.—The Morris Run Coal Mining Company will install a half mile of trolley line in its mine.

HARRISBURG, PA.—The Central Pennsylvania Traction Company is planning to extend its line to Lebanon.

NORRISTOWN, PA.—The Schuylkill Valley Traction Company contemplates building an extension of the Trappe & Limerick Electric Railway from Saratoga to Pottstown, a distance of 5 miles.

STEELTON, PA.—The Steelton, New Cumberland & Mechanicsburg Electric Railway, the proposed line into Steelton, will extend its lines from Lewistown to Newberrytown. The resolutions of the board of directors authorize a double or single line of track with the necessary switches and sidings over the route agreed upon.

DANVILLE, PA.—The Danville & Sunbury Trolley Company, a new corporation, has started the survey work at South Danville. Clyde C. Yetter, of Bloomsburg, is president of the company; Isaac Hagenbuch, of Bloomsburg, secretary, and W. A. Heller, of Danville, treasurer. The building of the line from Danville to Sunbury will serve as another link to the great trolley system that is rapidly advancing over the entire State. With the building of the line between Berwick and Shickshinny, and the Danville & Sunbury Road, the entire distance between Sunbury and Forest City by way of Wilkesbarre, Scranton and Carbondale will have been covered, making a total of 104 miles. A line to Shamokin, which it is expected will be built in the near future, will connect every town in Central Pennsylvania.

KNOXVILLE, TENN.—The Knoxville Traction Company is making extensive improvements on the Lonsdale line, which have been rendered necessary on account of the rapid increase of travel on this branch.

BONHAM, TEX.—The interurban line contemplated from Bonham to McKinney, via Edhube, Randolph, Trenton, Nobility and Blue Ridge, is progressing. Rights of way and land donations are being made right along. An executive committee in the towns has been named as follows: S. B. Howard, J. A. Moss, Bonham, Tex., and others.

NASHVILLE, TENN.—H. M. Gross, 319 Park Building, Pittsburg, Pa., president Nashville & Columbia Electric Railway Company, states that the contracts for constructing 55 miles of railway will be let about Sept. 1. The line will start at Nashville and pass through Brentwood, Franklin, Thompson, Spring Hill, Columbia and Mount Pleasant. W. D. Miller, of Sewickley, Pa., is chief engineer.

MONROE, WIS.—George W. Bowman has petitioned the Council for a twenty-year franchise for a city street railway. It is part of a projected system of 83 miles.

MONTREAL, CAN.—The Montreal Street Railway Company is doing a lot of heavy track laying this season, by which the roadbed of its different car routes will be much improved. The old 70-pound rails have been replaced by 96-pound rails. The contract with Delorimier for supplying a car service there has been signed. The residents of this suburb are now certain of having a quick means of transportation with Montreal.

GUELPH, ONT.—The Guelph & Goderich Railway Company, capital $125,000, has been organized to build an electric railway between the two points. Some 80 miles have already been surveyed. William Bell, of this city, is interested.

LEGAL.

PENNSYLVANIA-WESTERN UNION.—A cross bill to its suit against the Western Union Telegraph Company has been filed in the United States Circuit Court at Pittsburg by the Pennsylvania Company. The bill asks the court for a perpetual injunction against the defendant company to restrain it from using any portion of telegraph lines along the way of the Cleveland & Pittsburg Railroad, claiming the defendant company has no right to the use of the poles or wires, as all agreements and contracts made between the companies are now void. A partition of the property or the sale of the telegraph lines is also asked.

OBSTRUCTION BY POWER DAM.—In refusing on appeal to issue a writ of mandamus in the suit of the State ex rel Guenther et al against the Charleston Light & Water Company, the Supreme Court of South Carolina has made a decision summed up as follows: 1. Mandamus will not be granted to compel the removal of a dam obstructing a navigable stream, where petitioners show no special injury resulting to them other than that common to the general public. 2. A temporary obstruction of a navigable stream while remodeling a lock in a dam, the first one having proved defective, is not such an obstruction as will constitute a nuisance.

INJUNCTION ON A BOYCOTT.—At Hartford, Conn., on August 2, an injunction against 17 members of the local union of electrical workers was issued by Judge Case of the Superior Court on the application of the Rice & Baldwin Electric Company, of that city. The complaint declares that the defendants have conspired to injure the business of the plaintiff company by threats, intimidations and boycott, and the injunction orders them to refrain from further acts of the nature alleged. A hearing on the matter will be held September 6. This action is an outcome of the strike of the local electrical workers' union last December, resulting from the company's refusal to sign a new schedule presented by the men.

MARCONI STOCK LITIGATION.—Justice Bischoff, in the New York Supreme Court, has denied the application of the Greater New York Security Company for leave to join one Henry Gardner as a plaintiff in Gardner's suit against the Marconi Wireless Telegraph Company of America. Justice Bischoff said that the Marconi people had made the charge that the application was not made in good faith and added: "There appears to be much room for doubt as to the good faith of the petitioners, the Greater New York Security Company." The court also said: "There is a strong indication in the brief that the petitioner (the Greater New York Security Company) is acting at the instigation and for the benefit of a rival corporation by whom the litigation is controlled."

TELEPHONE POLES ON HIGHWAY.—The Appellate Division of the Supreme Court, New York State, has affirmed a decision in favor of the plaintiff in the suit of Little vs. American Telephone & Telegraph Company. The following are the points: (1) Where defendants erected telephone poles along a highway without consent of plaintiff's grantor, who owned the land to the center of the highway, defendant's occupancy of the premises after knowledge of the entry by plaintiff's grantor was under an implied license, which, having been initiated by a trespass, did not confer an easement on defendant to maintain the poles, but was subject to revocation at the will of the owner of the land. (2) Where plaintiff owned the fee in a highway to the center thereof, and defendant was a trespasser in the erection of telephone poles therein, plaintiff was entitled to maintain ejectment to oust defendant from the use of the highway, and was not required to bring a suit in equity, in which defendant's equitable rights, if any, might be adjudicated.

REDUCTION OF LIGHTING PLANT ASSESSMENT.—By a decision of Judge McCall, of the Supreme Court, the assessment on the personal property of the Edison Electric Illuminating Company, of New York City, levied for 1900 is reduced from $1,664,850 to $364,580, and an assessment of $80,000 on cables, switches, wires, meters and conduits, as real estate, is set aside entirely. The company reviewed the action of the Tax Commissioners in certiorari proceedings, and a referee was appointed to take testimony and report to the court. Judge McCall says he cannot agree with the referee on the question of the $80,000 assessment levied on the conduits, cables and wires as real estate. "In my judgment, under the facts revealed in this record," says Judge McCall, "the declaring of these mere incidents to the conduct of this relator's business to be real estate, situated, as the learned referee reports, not upon property owned by it, but on lands of the individuals to whom it was supplying electricity, was a pure fiction, without support of any law that I have been able to find."

RIGHT TO TELEPHONE SERVICE.—The Supreme Court of Arkansas has sustained the decision of the Circuit Court below in favor of the defendant, Southwestern Telegraph & Telephone Company, which, it was alleged, had discriminated in neglecting to give telephone service after repeated application. The summarized points of the decision are as follows: 1. Where a complaint states a cause of action defectively, it is not proper to take advantage of it by demurrer, but the remedy is a motion to correct the defect. 2. Where a complaint is defective in substance, in that it does not state facts in any form sufficient to make a cause of action, a demurrer is the proper remedy. 3. In an action against a telephone company, under Act March 31, 1885 (Laws 1885, p. 178, c. 107, § 11), declaring that telephone companies shall supply all applicants for telephone facilities without discrimination, and imposing a penalty for each day's continuance of any such discrimination, to be recovered by the applicant, the complaint alleged that defendant had failed to supply plaintiff with a telephone after repeated application, and that "by reason of the aforesaid discrimination" defendant had incurred a penalty. Held, that the complaint was demurrable, in that the allegation did not amount to a statement of facts constituting discrimination, but was a mere allegation of a conclusion of law.

LIABILITY FOR ESCAPING CURRENT.—The Supreme Court of Tennessee, in reversing the decision of the court below against the Memphis Consolidated Gas & Electric Company, held as follows: "Where defendant con-

tracted to furnish electricity for the illumination of a sign in front of a building, but had no interest in or control over the wires or appliances by which the electricity was conducted to the same, it was not liable for the killing of plaintiff's horse by electricity escaping from such wires through some defect in construction or a lack of perfect insulation." Citing cases in support of this view, the court said: "In each of these cases, the company furnishing the electric current had no interest in or dominion over the wires, the defect in which permitted the current to escape, so as to inflict the injury complained of. In the Kentucky case the court rested its conclusion upon the dangerous nature of the agency supplied. 'Considering,' said the court, 'the dangerous character of the force produced by the gas company, there was a duty imposed on each (that is, the furnisher and receiver) to see that the wires into which it was sent were properly insulated. The danger was exactly the same, whether the wire was owned by one or both of these corporation.' Pressed to its legitimate conclusion, we think this argument would make an electric or a gas company an insurer against defects in appliances over which they had no control, and, to avoid liability, would impose upon them the duty of continued inspection of the wires and pipes of every customer supplied with their products. This would be a burden which no such company could bear and live; and it also would be a source of annoyance to its customers, which they would not long submit to."

INJURY WITH ELECTRIC FLESHING MACHINE.—The Appellate Division of the New York Supreme Court, in an appeal from a judgment in favor of plaintiff, and from an order denying defendant's motion for a new trial, has reversed the lower court, the case being that of Austin vs. Fisher Tanning Company, for injury from an electric fleshing machine. The decision is thus summarized: (1) Where, in an action for injuries to a servant, negligence was alleged, in that defendant failed to make suitable rules for the safety of its employes, and the court's charge that if deceased, knowing that defendant had not made a rule that no machine should be started while it was being repaired, continued his employment, he thereby assumed the risk of defendant's failure to promulgate such rule, was not excepted to, such instruction constituted the law of the case on appeal. (2) Where a fleshing machine, run by electricity, consisted of a steel drum with an opening of about a quarter of its circumference, and knives fixed about the drum so close that when a hide was placed upon it they would remove the fleshings therefrom, and the entire drum was encased in a box, so that the refuse matter would not fly from the machine, the danger to a servant attempting to repair such machine while in operation was so open and apparent that no rule for the government of employes in that particular was required. (3) Deceased, whose duty it was to repair machinery in a tannery, was directed to repair an electric fleshing machine operated by F., who had been decedent's co-employe for a year and a half. Power was communicated to the machine by a shaft, which would revolve loose until a clutch was thrown into gear, when the drum of the machine would revolve toward the operator. The power could also be turned off entirely by an electric switch lever near by. Deceased, without turning off the power, but simply throwing the clutch out of gear, placed his head and shoulders in the drum, and, while so engaged, directed F. not to throw on the power. F., who was a foreigner, and unable to understand English perfectly, misunderstood the direction, and started the machine, by which deceased was immediately killed. It was no part of F.'s duty to operate or control the machine while deceased was repairing it, and deceased was familiar with the entire situation, including F.'s lack of knowledge of English, of which he had made no complaint to defendant. Held, that decedent assumed the risk of injury by reason of F.'s unfamiliartiy with the English language.

PERSONAL.

BARON WOLFGANG FERSTEL has been appointed by the Electrotechnischer Verein, of Vienna, as its delegate to the St. Louis International Electrical Congress.

MR. GEORGE G. KING has succeeded W. F. Crossley as manager of the Youngstown, Ohio, Telephone Company. The latter becomes state manager for the Colorado Telephone Company.

MR. VON BRAUN has been commissioned by the Minister of Industry and Public Works, Chili, to proceed to the United States for the purpose of studying the industrial applications of electricity in this country.

MR. W. MAVER, JR., has an excellent article on wireless telegraphy in the *American Review of Reviews* for August. It is written from a popular standpoint, but is also scientific as well as clear and concise.

MR. HUGH L. COOPER, chief engineer of construction of the Necaxa-Mexico City-El Oro power transmission system of the Mexican Light & Power Company, Limited, 29 Broadway, New York, is now on a visit to the States.

MR. H. R. WELLMAN, who has been in charge of the motor department of the General Incandescent Arc Light Company for the past five years, is leaving that concern to enter the engineering department of the Western Electric Company, at Chicago, Ill.

MR. JOSEPH B. BAKER, the consulting engineer and technical journalist, of Boston, has joined the publication bureau of the General Electric Company, under Mr. Martin P. Rice, at Schenectady, N. Y. Mr. Baker's work is familiar to the readers of these pages.

MR. CYRUS ROBINSON, vice-president of the Power & Mining Machinery Company, has just returned from Europe, where he spent some time looking up the subjects of gas producers and the gas engine business. The American Crossley gas engine is manufactured by his company in the United States.

LIEUTENANT VOGELGESANG, who commanded the turret on the battleship Wisconsin which attained the highest merit of any twelve or thirteen-inch electrical turret, winning the prize for that class of turret in the last annual target practice, has been commended by the Navy Department for the zeal and ability displayed as a turret officer.

DR. CHARLES V. DRYSDALE, of the electrical engineering department of the Northampton Institute, Clerkenwell, London, of which Dr. R. M. Walmsley is the principal, has arrived by the White Star liner Baltic, and after looking over electrical matters in the East, will proceed to St. Louis, to serve on the electrical jury. He expects to return home toward the end of September.

MR. W. H. WHITESIDE.—At a meeting of the board of directors of The Bullock Manufacturing Company, held on the 30th of July, Mr. W. H. Whiteside, general manager of sales of the Allis-Chalmers Co., was appointed general manager of sales of The Bullock Electric Manufacturing Company, so that he will have entire charge of the sales departments of both the Allis-Chalmers and Bullock organizations.

RICE-WEIBEZAHN.—Mr. Calvin Winsor Rice, special electrical engineer for the General Electric Company, in New York City, was married at Winchester, Mass., on August 6, to Miss Ellen Moseley Weibezahn, daughter of Mr. and Mrs. W. E. Weibezahn, of that town. The happy pair have the warmest congratulations of a host of friends in electrical circles, in which Mr. Rice is so well known and popular.

MR. MAX OSTERBERG.—We regret to state that Mr. Max Osterberg, the consulting electrical engineer, of New York City, was taken suddenly ill about a week ago with cerebral apoplexy. The doctors have not given up all hope of his recovery, but his condition will probably never be so much improved that he can resume his former duties in the electrical field. A host of friends and acquaintances will be deeply grieved at this check to a promising professional career.

OBITUARY.

MR. A. J. CORRIVEAU.—A special telegram from Ottawa, Ont., of August 7 says: "Late yesterday at Montreal, A. J. Corriveau, vice-president of the Montreal Auto Club, and one of the city's best known citizens, received terrible injuries from which he died before his wife, who was away, could return to the city and see him. While driving an auto on his way to an auto garage, he collided with a street car. He struck with great force, was hurled headlong against the sidewalk and was picked up unconscious. His skull was fractured. He never regained consciousness and died six hours later." Mr. Corriveau, who was well known in New York, was at one time very active and prominent in the Canadian electric lighting field, and although of late he had engaged in automobile development, he retained large interests in electric railways. It was through his advocacy, that the National Electric Light Association was induced to visit Montreal some years ago, when it was given a splendid reception by the citizens. Mr. Corriveau left a son, who is practicing as a civil engineer under the Canadian Government.

NEW INDUSTRIAL COMPANIES.

THE RADIO INCANDESCENT BURNER COMPANY has been formed at Newark, N. .; capital, $210,000. Incorporators, William Hewins, Felix Emmanuelli, David D. Jones.

THE JOHN R. LEE ELECTRICAL CONSTRUCTION COMPANY has been incorporated with a capital stock of $300,000. It will build the Buffalo, Lockport & Rochester trolley road.

MEARS EAR PHONE COMPANY has been incorporated under the laws of New York with a capital stock of $100,000, by W. S. Mears, L. G. Laureau and Emanuel Lewis, of New York City.

BROOKLYN, N. Y.—The A. Newberger Electric Company, of Brooklyn, has been incorporated. Its directors for the first year are as follows: Herman De Vos, Rentfro B. Banton and Banton Moore, of Brooklyn.

MINNEAPOLIS, MINN.—The American Melaphone Company, of Minneapolis, has filed articles of incorporation. Its capital stock is $50,000 and it will manufacture melaphones. H. P. Watson, Sumner F. Porter and D. L. Raymond are the incorporators.

THE HOLABIRD-REYNOLDS ELECTRIC COMPANY has been incorporated at Los Angeles, Cal., with a capital stock of $25,000, of which $12,000 has been subscribed. The directors are R. Reynolds, A. Halstead, E. Bailey, Pasadena; R. Holabird and C. Davis, Los Angeles.

PORTLAND, ME.—The Imperial Electric Motor Company has been formed, capital $1,000,000, nothing paid in. President and clerk, M. W. Baldwin; treasurer, H. E. Mason, both of Portland. Directors: as above, and G. E. Riker, J. R. Griffin, J. J. Hernan and J. L. Etter, all of Portland.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, of Plainville, Conn., has decided to manufacture panelboards and switchboards, in addition to its other specialties. Mr. H. A. Fisher, lately with the Chase-Shawmut Company, of Boston, will have charge of the new department.

SOUTHERN ELEC. & MFG. COMPANY.—The city of Anniston, Ala., has awarded two acres of land to the Southern Electric & Manufacturing Company on which to erect its buildings. They will be equipped with steam heat, electric lights and hot and cold water. The machinery will be driven by electric motors hanging from the ceiling. The company has a capital stock of $1,000,000, and will manufacture electrical supplies and specialties, fixtures, fans, etc. The officers of the company are: President, Frank G. Lake; vice-president, R. W. Munk; secretary and manager, W. L. Goodhart; treasurer, E. H. Goodhart; directors, Frank G. Lake, R. W. Munk, W. L. Goodhart, E. D. Tomkins and E. H. Goodhart.

Trade Notes.

THE EXCELSIOR WOODEN PIPE CO., of San Francisco is installing 60-inch California redwood pipe for the gravity conduit of the Cornell University power plant for which the Abner Doble Company, also of San Francisco, has the contract for the water-wheels.

MOTOR-DRIVEN LATHE.—In connection with the big motor-driven lathe of the American Tool Works Company, of Cincinnati, described in these columns last week, it is interesting to note that the motor used is a 25-hp built by the Crocker-Wheeler Co., of Ampere, N. J.

THE LANE & BODLEY CO., Cincinnati, Ohio, on private mailing cards illustrates its twentieth century, heavy duty Corliss engines, link-motion heavy duty winding engines and gives a view of the direct connected Corliss engine now operating the intramural railway at the St. Louis Exposition.

THE AMERICAN ELECTRIC FUSE COMPANY has on exhibition at its office in Chicago, 50 W. Jackson Boulevard, one of the company's latest type, Allen-Bradley electric crane controllers, and is pleased to give demonstrations of it to anyone interested. This controller has recently been tested by a number of the largest manufacturing companies in the United States, and without exception, the tests have been highly satisfactory. The controller is guaranteed for one year to purchasers.

E. W. BLISS CO., Brooklyn, N. Y., has issued bulletins No. 2-B and 3-B descriptive of the "Stiles" power punching presses and sprue cutters, and of the "Bliss" straight-sided power presses. These presses find an extensive use in the manufacture of all kinds and grades of electrical apparatus and serve for the formation of both the magnetic and electric circuits of electrical machinery. Miniature pocketbooks which the company is distributing contain much well tabulated information of daily use to the electrical and mechanical engineer.

FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., in Bulletin No. 1057 outline the advantages of their new type of multiphase, revolving field generators, built in sizes from 25 to 450 kw, either two or three-phase. Bulletin No. 1056 issued by the same company describes in detail the core, coils and insulation of the Type A transformer, which has given uniformly good service in operation. A price list of parts of the "Wood" Form C arc lamps for 104 volts alternating current, is given in catalogue No. 2010.

SUNBEAM INCANDESCENT LAMP COMPANY, New York, in an attractive catalogue describes the "Sunburst" lamp. The lamp is of artistic design, and its construction is such that the full rated candle power is obtained in the lower hemisphere over an area included within an angle of 45 degrees from the perpendicular. The standard lamps show an efficiency of 2.4 watts per candle. While the company is prepared to furnish lamps showing a consumption of 2 watts per candle, these are not recommended for general use.

BABY BUNGHOLE LAMPS.—The special attention of the trade is being called to the "New Baby Bunghole Lamp," which is being furnished by the Sunbeam Incandescent Lamp Company through its sales agents, the Western Electric Company, at Chicago, New York and other principal cities. They are particularly adapted to decorative work, and are made in all voltages from 90 to 130, 2 and 4-c.p.

ACHESON GRAPHITE.—Bulletin No. 6, issued by the International Acheson Graphite Company, Niagara Falls, N. Y., deals with the adaptability of Acheson graphite articles for electrolytic processes, electrodes for electric furnace work, stirrers for molten metals, plungers and pistons for dash-pots, etc. Its sphere of usefulness embraces all the lines of work in which the ordinary forms of carbon have heretofore been used.

BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, has issued Bulletin No. 1030, covering its shell type transformers. The methods of building up the core, installing the cooling pipes, winding and spacing the high and low voltage coils, and insulating and cooling of the completed transformers are treated at great length. The company is equipped to build these transformers in lots for prompt shipment.

TELEPHONE CATALOGUE.—The Conn. Tel. & Elec. Company, of Meriden, Conn., has just issued its new catalogue, No. 8. This issue is most complete, covering exchange apparatus and also a large line of interior telephone systems. The Conn. people state that they are manufacturing all parts from the raw material in their own factory. A copy of their new and enlarged catalogue will be mailed on request, also their various bulletins.

MEERSCHAUM FOR INSULATION.—William Demuth & Co., manufacturers of smokers' articles, 507-9 Broadway, New York, announce that they are prepared to supply meerschaum in bulk at reasonable prices. As is well known, the substance is light in weight, non-hygroscopic, fire resistive, and being a non-conductor is suitable for insulating purposes. The company does not appear, however, to be in possession of any electrical or other tests.

THE COLUMBUS STORAGE BATTERY will hereafter be manufactured and marketed by the Dayton Manufacturing Company, Dayton, Ohio. G. W. Frost, sales manager of the Columbus Storage Battery Company, will go with the Dayton Manufacturing Company to take charge of the sales of the storage batteries which the latter company will now produce. J. W. Frost, manager of the Columbus Storage Battery Company, will remain in business in Columbus under the name of Frost Manufacturing Company, making primary spark coils.

AUTOMATIC TELEPHONY ABROAD.—The Deutsche Waffen und Munitions Fabriken, Berlin, Dorotheen Str. 43-44, in a catalogue just issued, describes the Stowger automatic telephone system, a full account being given of the details of construction and operation of the calling apparatus and the substitute employed for the central girl. The features of the automatic selective interconnecting sets at the exchange are fully covered, illustrations of the 6000-set installation at Dayton, Ohio, being given as showing an equipment in successful operation.

THE NATIONAL ELECTRIC COMPANY, successor to the Christensen Engineering Company, Milwaukee, manufacturer of Christensen air brakes and electrical machinery, has just completed extensions to its foundries, and is soliciting orders for open hearth, crucible steel, semi steel, iron and brass castings. Its foundries are equipped with every facility for rapid and economical output, and as the nature of its own work demands castings of the highest grade, material furnished on orders will be of the same quality, and receive immediate attention.

THE WORTHINGTON STEAM-HYDRAULIC ACCUMULATOR is described in Bulletin 100, published by Henry R. Worthington, 114 Liberty Street, New York City. This device consists of an ordinary steam cylinder, combined with a ram cylinder similar to that of a weighted hydraulic accumulator, and is applicable to all purposes requiring the storage of water under high pressure. Its advantages over the weighted accumulator are said to be that it is cheaper and occupies less room, and is free from the shocks and fluctuations of pressure due to the momentum of the heavy weights used on weighted accumulators.

THE F. BISSELL COMPANY, Toledo, Ohio, has in process of construction at its factory there some large power switchboards for a big dry goods house in the Middle West. A big shipment of panel boards was made recently to Winnipeg, Manitoba. Its switchboard business is rapidly assuming importance, and the company has been compelled to increase its facilities. It carries a large stock of standard boards to fill any ordinary demand; but, of course, special boards are built to suit individual specifications. The company's handbook is particularly valuable to contractors and engineers, as it enables them to arrive quickly at the exact cost of almost any switchboard called for. This handbook is mailed free on request to any contractor or engineer.

ETIQUETTE OF THE TELEPHONE.—Doubtless there is not a business man in the city who has not had occasion many times to call the attention of some of his clerks to the fact that each person who rings up on the office telephone is not a personal enemy. The ordinary office clerk who responds to a telephone call takes on a tone of voice as though he were answering under protest. He is surly, sharp and disagreeable—at least that's the way it sounds. It is to overcome this difficulty that a little card, attractively printed and without an advertisement on it, is now being hung close by the telephone in many offices. It tells how a telephone call should be responded to. Frank A. Burrelle, a pioneer among press clippers, sent out the cards quietly to his friends, and the soundness of the idea took, with the result that the cards have become a habit.

NEW YORK CENTRAL AFLOAT.—The Western Transit Company, which is the New York Central & Hudson River Railroad's freight connection on the Great Lakes, has recently put into commission the new steamer Duluth, the largest and most modern package freight vessel on the Great Lakes. She is 401 feet long, 50 feet beam and 30 feet depth, with a carrying capacity of 6000 tons. This makes seven modern steel steamers in the Western Transit Company's fleet, six of which have been added since 1898, it being the company's policy to add a new steamer each year. In addition to these steel steamers, the company has nine iron and wooden steamers, which, while not quite as modern as the steel boats, are still admirably adapted for lake freight transportation. This fleet of sixteen steamers enables the New York Central to give a daily freight service from Buffalo to Milwaukee, Chicago, Duluth and Portage Lake. Evidently the New York Central rules the waves as well as the rails.

WARNER ARC LAMP COMPANY.—Mr. W. F. Warner, of Muncie, Ind., gives the following reasons why he does not put a switch on his arc lamp: "In the first place, I consider the switch ordinarily found on arc lamps as an invitation to trouble. In all of my experience with all types of arc lamps, I have ever found it to be a source of considerable trouble, often opening the circuit in the lamp, and placing considerable extra resistance in the line. It is positively dangerous, because the ordinary lineman is willing to risk his life handling a lamp on a live circuit after he has closed the little switch, when, as a matter of fact, he is in just as much danger as if the switch was left open, because the lamp is still connected to the line. What is needed is a cut-out switch, to be entirely separate from the lamp. This can be placed on a hanger board, at the top of the lamp, or can be placed on the nearest pole. Or if the lamp is used inside, it can be placed at most any convenient location; for regular street lighting, I do not consider any switch necessary. The trimming is done in the daytime, and at night the lamp is expected to be burning. My lamp will positively not open the circuit, even if the carbons are entirely burned out, but will automatically close the circuit. What more is needed?"

THE POWER & MINING MACHINERY COMPANY started business a little over a year ago, having secured the works of the Nolthoff Mining Machinery Company at Milwaukee, where it immediately commenced extensive improvements for the manufacturing of its gas machinery. The extension of these works was begun in August, 1903, about one year ago; and the same are hardly completed, but will be ready within sixty days for extensive operations. In the meanwhile the company has taken upward of a million dollars' worth of orders for Loomis-Pettibone gas apparatus and Crossley gas engines, which are being constructed in their shops at the present time. These orders have been placed with companies, among which are the following: Velardena Mining & Smelting Company, Velardent, Durango, Mexico; F. W. Snow, Hillburn, N. Y.; Gould Coupler Company, Depew, N. Y.; D. Lovejoy & Son, Lowell, Mass.; Ramapo Iron Works, Hillburn, N. Y.; Pennsylvania Steel Company, Steelton Pa.; Dufresne & Locke, Montreal, P. Q., Canada; Milford Electric Light Company, Milford, N. H.; Motor Engine Company, 15 William Street, New York City; Potosina Electric Company, San Luis Potosi, S. L. P. Mexico; Amparo Mining Company, Drexel Building, Philadelphia, Pa.; International Steam Pump Company, 114 Liberty Street, New York City; Atha Tool Company, Newark, N. J.; Elmira Water, Light & Railroad Company, Elmira, N. Y.; Sayles' Bleacheries, Saylesville, R. I.; W. H. Cone, Berlin, Ont., Canada; Bay State Forge, Cambridge, Mass.; Newton Gas & Electric Company, Newton, N. J.; Lexington Railway Company, Lexington, Ky.; Wellington Meat Export Company, Limited, Wellington, N. Z.; Avino Mines of Mexico, Limited, Avino, Durango, Mexico; Phelps, Dodge Company (Montezuma Copper Company), Nacozari, Sonora, Mexico; Taylor Manufacturing Company, Columbia. S, C., and others.

Record of Electrical Patents.

UNITED STATES PATENTS DATED AUG 2, 1904.

[Conducted by Rosenbaum & Stockbridge, Patent Att'ys, 140 Nassau St., N. Y.]

766,171. APPARATUS FOR SIGNALING FROM GRAVES; Edwin S. Crosby and Ell R. Henry, Lake Charles, La. App. filed Nov. 27, 1903. Apparatus whereby both aubible and visible signals will be actuated upon the return of animation in a buried person and whereby oxygen will be supplied to the buried person to sustain life until the casket can be disinterred.

766,177. TROLLEY; Orin Funkhouser, New Brighton, Pa. App. filed June 26, 1903. Details.

766,187. MEANS FOR EXTINGUISHING ARC; Rudolf E. Hellmund, New York, N. Y. App. filed Nov. 28, 1903. A quantity of pulverulent substance, such as sand, is projected between the separated parts of a switch or fuse at the time of separation, for extinguishing the arc when the circuit is opened.

766,229. SPEED CONTROLLER; Edwin Rust Douglas, East Orange, N. J. App. filed Feb. 24, 1903. The purpose of the invention is to maintain a constant peripheral speed of a rotary part, such as an emery wheel, which is actuated by an electric motor, the invention consisting of a pivoted lever which bears against the periphery of the rotary part and is connected with the lever of the electric controller, whereby the speed of the motor is increased as the diameter of the rotary part decreases.

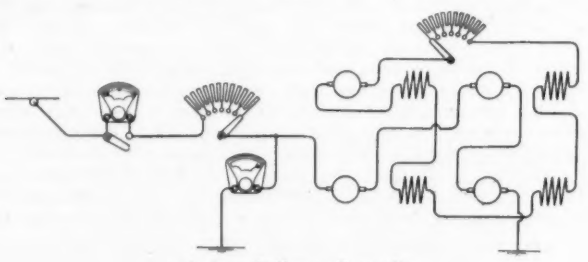
766,248. MECHANICAL ELECTRIC CURRENT INTERRUPTER OR CIRCUIT BREAKER; John O. Heinze, Jr., Lowell, Mass. App. filed March 9, 1904. The invention consists of means whereby a set of two or more spark gaps may be formed simultaneously in an electric circuit and reproduced in rapid succession. Two or more insulated rotating commutator segments are provided, which are so arranged that the bruises connecting said segments in series simultaneously interrupt or break the circuit into a series of two or more spark gaps or breaks which are rapidly reproduced.

766,284. INSULATED HANGER FOR ARC LAMPS; Henry J. Pfiester, Cincinnati, Ohio. App. filed March 7, 1903. Details.

766,288. ELECTRIC WELDING CLAMPING DEVICE; Adolph F. Rietzel, Lynn, Mass. App. filed Dec. 4, 1903. A jaw-carrying slide or block and a screw for adjusting its position with reference to the opposite jaw, are provided in connection with a detachable jaw-face and a fastening rod passing longitudinally through the adjusting screw.

766,311. CIRCUIT BREAKER; Gilbert Wright and Harold C. White, Pittsfield, Mass. App. filed Oct. 7, 1903. The purpose of the invention is to provide a tripping device which will operate with minimum friction and a setting device therefor which will permit of delicate adjustment and at the same time give an indication throughout its length of the exact point at which the tripping mechanism is set.

766,313. APPARATUS FOR FREEING OIL WELLS FROM OLEAGINOUS



766,381.—Railway Controller.

OBSTRUCTIONS; James Yoast, Lima, Ohio. App. filed Nov. 2, 1903. The invention consists of what is known as an oil-well "cooker" which is adapted to be lowered to the point in the well where the obstruction, generally in the form of paraffin, is located, and then by the use of an electric current producing heat to melt such obstruction, the same comprising an air-tight casing, a centrally located, metal supporting rod therein, an insulating core surrounding the rod, resistance material surrounding the core, and electrical connections to the resistance material to cause the heating of the same.

766,319. SWITCH ATTACHMENT FOR CLUSTER ELECTRIC FIXTURES; Walter L. Bradshaw, Cambridge, Mass. App. filed May 27, 1904. The switch cord is connected through a spider to the body of the cluster casing, instead of to the base plate of said casing, in order to prevent the pulling off of said base plate by jerks upon the cord.

766,327. CONTROLLER; Fred B. Corey, Schenectady, N. Y. App. filed Feb. 4, 1903. The invention resides in the construction of the reversing switch of the controller, the said switch having one or more semi-cylindrical members, mounted so as to embrace the operating shaft of the switch, each of said members being made up of insulating material molded into the proper shape and having the connecting members of the contact segments molded into the insulating material.

766,335. ELECTRIC RAILWAY; Philip Farnsworth, Schenectady, N. Y. App. filed Feb. 21, 1901. In this invention the conductor which supplies current to the car motors is divided into sections normally disconnected from the feeder, but which are adapted to be connected thereto by electromagnetic switches as the car proceeds. The novelty consists in employing electro-magnetic means for positively opening the switches which connect the conductor sections with the feeder, so they cannot remain closed by residual magnetism or leakage currents or become accidentally closed

766,351. REVERSING SWITCH; George H. Hill, Schenectady, N. Y. App. filed March 11, 1903. A reversing switch cylinder is employed which is built up of a plurality of identical units, each unit comprising a disk of moulded insulating material having an opening through which the shaft on which said unit is mounted is adapted to pass, and carrying a pair of conducting elements embedded in said insulating material, each of said conducting elements carrying a contact segment which may or may not be replaceable.

766,360. FIRE ALARM SYSTEM; Benjamin P. Ketcham, Carthage, N. Y. App. filed Aug. 6, 1903. Details of a system whereby an alarm may be sent in from different parts of a town or village and the location of the fire indicated at the engine-house, as well as a bell sounded to notify the inhabitants of a fire and a signal given at the house of each member of the company simultaneously with the operation of the bell or general signal.

766,370. WINDING MACHINE; James F. Middleton, Pittsfield, Mass. App. filed May 8, 1903. The machine of this patent is designed for winding metal strips into coils, such as the field coils for large dynamo-electric machines where large current carrying capacity is desired. A face plate is loosely mounted upon the main shaft, a continuous gear-rack is carried by the face plate and means are provided for permitting lateral and longitudinal motion of the rack relative to the face plate, in connection with a gear secured to the shaft and adapted to mesh with said rack and means for maintaining the latter in engagement with the gear.

766,381. ELECTRIC RAILWAY AND CONTROLLING DEVICE THEREFOR; William B. Potter, Schenectady, N. Y. App. filed March 3, 1898. By this invention the number of wires which are required to control a single switch or a number of switches from a distant point is reduced and at the same time the controlling circuits are rendered independent of the circuits through the switch actuating coils.

766,391. REMOTE SWITCH CONTROL SYSTEM; John L. Hall and Howard R. Sargent, Schenectady, N. Y. App. filed Nov. 26, 1902. This invention aims to return to the distributing system of an electric railway the energy absorbed by the application of the brakes in stopping a car or train, and consists in connecting motor armatures in series when it is desired to return energy, so that their electro-motive forces act to supply current to the line at a voltage in excess of that impressed thereon by the main generator.

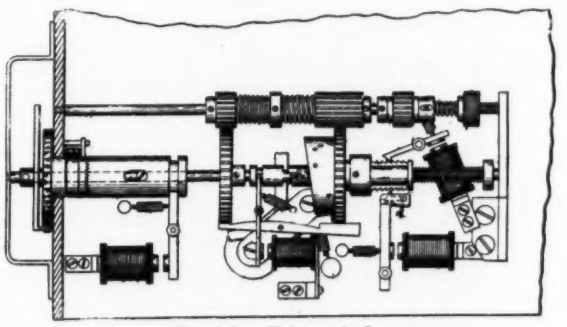
766,399. CURRENT-COLLECTING DEVICE FOR ELECTRIC RAILWAY SYSTEMS; Abraham A. Shobe and William Embley, Jerseyville, Ill. App. filed Sept. 26, 1903. A current collector for an underground conductor is provided in which the movable conducting members are held at all times firmly in engagement with the stationary conductors without regard to uneven movement of the car, irregularities in the roadbed or variations in the position of the conductor.

766,430. TELEGRAPHIC INSTRUMENT; Arthur E. Dickey, Missouri Valley, Iowa. App. filed May 13, 1902. The sounders in any number of telegraphic circuits are cut by a single instrument, instead of providing a cut-out for each sounder.

766,454. APPARATUS FOR EXPLODING MINES, BLASTING, ETC.; Fred L. M. Masury, Brookfield Township, Trumbull Co., Ohio. App. filed Feb. 3, 1904. Details of an apparatus for exploding mines, etc., in which a dry battery or accumulator battery for generating the electric current is employed, instead of an electric generator, including a revolving amature.

766,469. SYSTEM FOR TEMPERATURE REGULATION; Frederick M. Schmidt, New York, N. Y. App. filed Jan. 7, 1903. This system is designed for the regulation of the temperature of a room or building in which a thermostatic bar is employed which is adapted by its attraction and expansion to make an initial contact, and is used in connection with devices which thereafter complete the contact to energize the valve or damper-operating mechanism, whereby the bar is, in effect, relieved of its function after the initial contact.

766,474. RECEIVING TELEGRAPH INSTRUMENT; Charles R. Underhill, Providence, R. I. App. filed June 1, 1903. This invention is designed for the production of an instrument by means of which the code characters of a telegraph code may be translated into the ordinary letters,



766,474.—Receiving Telegraph Instrument.

figures, etc., of a language, and a record made of the characters into which the code signals are translated.

766,490. CUT-OUT; Ferdinand Buchhop, New York, N. Y. App. filed Oct. 29, 1903. This cut-out comprises a fixed plate opposite and parallel to which is arranged a rotary disk carrying on the surface opposed to the plate a pair of contacts adapted when the disk is in one position to make contact with said plate and when in another position to straddle the plate without making contact thereafter.

766,496. ELECTRIC ARC LAMP; Arthur S. Deem, Reading, Pa. App. filed Jan. 26, 1904. Details.

766,497. BALANCED CORD-DROP ATTACHMENT; Henry D'Olier, Jr., Philadelphia, Pa. App. filed March 7, 1904. The invention consists of means whereby an incandescent lamp when supported by a drop cord or other fixture and held in approximately horizontal position, may be rotated to any position about the drop cord or other support as an axis, whereby the lamp may be independent of the twisting effects of the cord or other support, and means whereby electrical communication is maintained between the lamp and the cord or fixture irrespective of the position to which the lamp may be turned.

766,532. DEVICE FOR SAFEGUARDING VESSELS; Frank Schmitt, Philadelphia, Pa. App. filed Oct. 14, 1903. Details of a device for preventing collision between vessels and for preventing vessels from striking sand bars or other obstructions.

766,625. THIRD RAIL SYSTEM; Thomas Jenkins, New York, N. Y. App. filed April 6, 1904. A protecting cover is provided for the third rail and a support for the contact shoe which will permit the shoe to be moved into and out of the cover and coact with the rail.

766,650. ELECTRIC TROLLEY; George Ondo, Delancey, Pa. App. filed March 10, 1904. Details.

766,692. HANGER CUT-OUT FOR TROLLEY WIRES; George Hall, Manchester, England. App. filed April 3, 1903. Details.

766,767. ELECTRIC CONNECTION ROSETTE; Mortimer Norden, New York, N. Y. App. filed Sept. 19, 1903. Details.

766,787. INCLOSED ARC LAMP; Ozro N. Wiswell, Lynn, Mass. App. filed May 4, 1899. The purpose of the invention is to prevent the introduction of oxygen into the inclosure in which the carbons are located and to maintain in the inclosure a body of carbon gas. A chamber is provided into which the inert gas is forced by the movement of the carbon in one direction instead of allowing it to escape into the atmosphere, which inert gas may be drawn back into the inclosure by the movement of the carbon in the opposite direction instead of drawing atmospheric air or oxygen therewith.

766,788. INCLOSED ARC LAMP; Ozro N. Wiswell, Snoqualmie Falls, Washington. App. filed July 24, 1902. Discloses a modification of the construction shown in the last patent, consisting of a plate having a carbon-opening and arranged to engage with an end of the globe and a chamber communicating with the carbon-opening at one point and with the atmosphere at another, into which the gas from the inclosure is free to enter and withdraw as the carbons move with respect to each other.

766,800. BALANCED CORD-DROP ATTACHMENT; Henry D'Olier, Jr., Philadelphia, Pa. App. filed March 4, 1904. This invention has the same object in view as that disclosed in patent 766,497, above referred to. The same consists of an attachment plug, a member secured thereto and a lamp socket in said member, the axis of said socket being at an angle with the axis of the attachment plug.

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But will we ever own
A cussless, waitless, out-of-orderless,
Girlless telephone?
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Makes No Clerical Errors

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"MODEL 15" records the time a man works in hours and tenths or hundredths of an hour.

Let us tell you about it.

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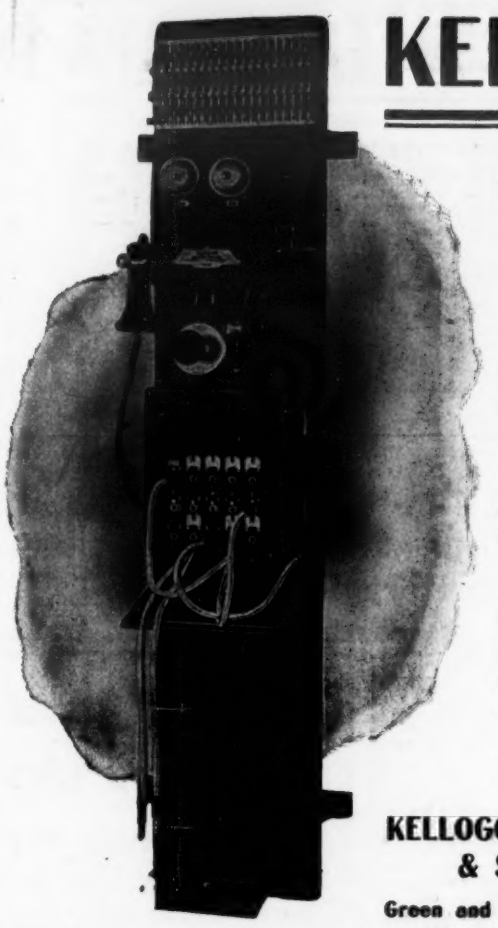

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Kellogg Telephone Apparatus is simplest, most efficient in operation, and in the end undoubtedly the cheapest.

Write for our latest telephone quotations.

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WIRELESS TELEGRAPH SYSTEM

The Fessenden system operates under all weather conditions, is free from interference, employs the most efficient receiver, is ideally simple.

It employs no coherers, vibrators, induction coils or other fallible devices. Is reliable in every respect, fully developed and standarized.

100-mile sets supplied from stock. (1)

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A Modern Necessity.....

Home... THE TELEPHONE—Shops, orders, notifies, engages, changes. Keeps you in touch with your office and the world at large.

Office... Brings your present trade within arm's reach irrespective of actual physical distance intervening and urgently invites new business.

Factory Private Branch Exchange—the perfection of intercommunicating and exchange service. Write for Pamphlet.

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B. W. TRAFFORD, General Contract Agent

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The Biaphone

WALL SETS $5.00 PER PAIR

Fully guaranteed telephones, highest grades, solid back transmitters.

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They may never have known, or they may have known years ago.

They may still have a partial knowledge; but unless you

ADVERTISE PERSISTENTLY

it does not take very long to be forgotten.

NOTICE OF REMOVAL

WE WISH TO ANNOUNCE THE REMOVAL OF OUR OFFICE AND FACTORY TO GIRARD, PENNSYLVANIA, ON THE L. S. & M. S. AND PENNSYLVANIA RAILROADS, WHERE MODERN FACILITIES AND ADDITIONAL SHOP EQUIPMENT WILL ENABLE US TO GREATLY INCREASE OUR OUTPUT AND FACILITATE THE PROMPT AND EFFICIENT HANDLING OF ORDERS.

OUR RAPIDLY INCREASING BUSINESS HAS COMPELLED US TO MAKE THIS CHANGE AND WE HAVE SPARED NO EXPENSE IN MAKING OUR NEW QUARTERS MODERN AND UP-TO-DATE IN EVERY RESPECT, WITH PLENTY OF ROOM FOR EXPANSION.

IN CONSEQUENCE WE SHALL BE IN BETTER POSITION THAN EVER TO MAINTAIN THE HIGH STANDARD OF EXCELLENCE SET BY THE MANY GENERATORS AND MOTORS OF OUR CONSTRUCTION THAT ARE NOW IN USE, AND WHICH HAVE ALREADY ESTABLISHED A REPUTATION FOR US IN THE ELECTRICAL FIELD.

FEDERAL ELECTRIC COMPANY

ERIE, PA.

If Watson Motors were built just to sell they might be built cheaper and for a while more might be sold.
Instead they are built to

Do the Work.

Their economy does not begin and end with their purchase. It lasts as long as they are in operation.

It is not in low first cost but in efficiency, durability, economy in operation and lack of necessity for repairs. They earn a dividend every day.

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WATSON MOTOR

Stands for the best in material and workmanship that money can buy.

Built for either gear or belt connection.

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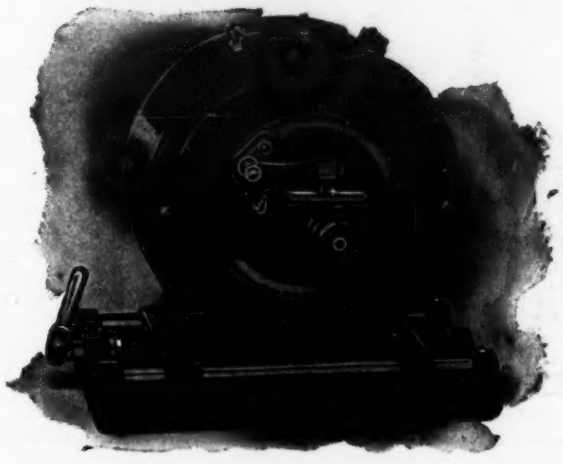
The
Standard Motors



SPECIFICATIONS

For the entire line:

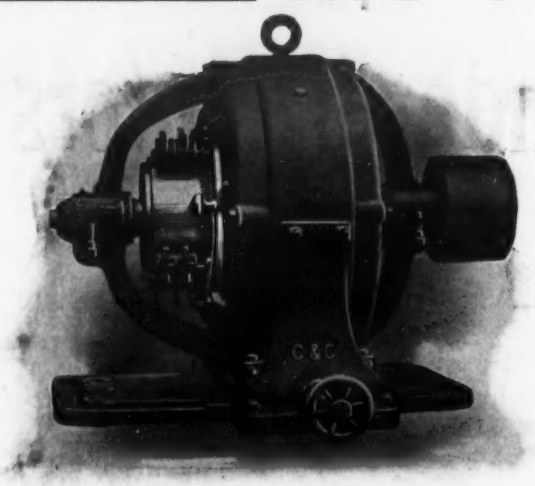
Number of frames, 15.
Voltages, 20 to 650.
Brake Horse-power, 1-30 to 15.
K.W., 1-2 to 10.
Speed range, universal.
With or without sliding base.
Idlers when required.
Back-geared motors, any reduction.
Open.
Protected.
Gauze enclosures.
Half enclosures.
Solid, dust-proof enclosures.
Variable speed.
Mounting, floor, side wall or ceiling.
Reversible rotation.
Laminated pole pieces, frames 3-4 to 12 1-2.
Ventilated armatures, forced draft, frames 1 to 12 1-2.
Hard-drawn copper commutators.
Form-wound coils.
Standard windings in stock.
Special windings on short notice.

The Robbins & Myers Co.,

Main Office and Works, Springfield, O.

New York Office, 170 Broadway.

Our New Line of TYPE "S" Open Style DYNAMOS and MOTORS



10 H.P. Open Floor Style Type "S" Motor

FRAME No.	MOTORS						DYNAMOS				Weight (Pounds)	
	Slow Speed			Moderate Speed			Slow Speed		Mod. Speed			
	H. P.	Speeds 110 220 440 Volts	Speeds 125 250 500 Volts	H. P.	Speeds 110 220 440 Volts	Speeds 125 250 500 Volts	K. W.	Speeds 125 250 500 Volts	K. W.	Speeds 125 250 500 Volts	Net	Shipping
"S 2"	1½	1,150	1,275	2	1.530	1,700	1½	1,340	1⅞	1,780	150	185
"S 3"	2	990	1,100	3	1,485	1 650	1⅞	1,160	2¾	1,735	215	275
"S 5"	3	900	1,000	5	1.485	1,650	2⅞	1.050	4½	1,735	285	355
"S 7½"	5	880	975	7½	1.305	1,450	4½	1,025	6½	1,525	460	540
"S 10"	7½	835	925	10	1,125	1.250	6½	976	8½	1,315	575	655
"S 15"	10	745	825	15	1.080	1,200	8½	870	13	1.260	805	925
"S 20"	15	745	825	20	990	1.100	13	870	17½	1,150	1,070	1,200
"S 25"	20	720	800	25	900	1,000	17	840	20¾	1,050	1,315	1,460
"S 30"	25	675	750	30	855	950	20	790	25	1,000	1,540	1,700
"S 40"	30	630	700	40	860	950	25	740	35	1,000	1,960	2 150

Sold under the following GUARANTEES—the STRONGEST EVER MADE:
Temperature rise not exceeding 30° C. after 24 HOURS' run at FULL LOAD
Temperature rise not exceeding 35° C. after 12 hours' run at FULL LOAD, immediately followed by 2 HOURS' run at 25% OVERLOAD.
No sparking under above conditions.
50% OVERLOAD capacity for 2 HOURS or 100% OVERLOAD capacity for ½ HOUR without injury.
Highest attainable efficiency.

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MODERN DESIGN

The Keystone Electric Co.

DYNAMOS MOTORS SWITCHBOARDS

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Cast Iron Frames Laminated Poles
1 K. W. to 750 K. W. 1500 r. m. p. —90 r. p. m.

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Variable Speeds Standard Designs
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We have ready for immediate delivery direct-current motors from ½ to 15 H. P.

We have an interesting proposition to make to agents. Write for particulars Dept. B.

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Multipolar, Simple, Compact, Sturdy, and designed for high-speed service.

This motor is being requisitioned by elevator manufacturers as meeting the requirements of their work better than any other.

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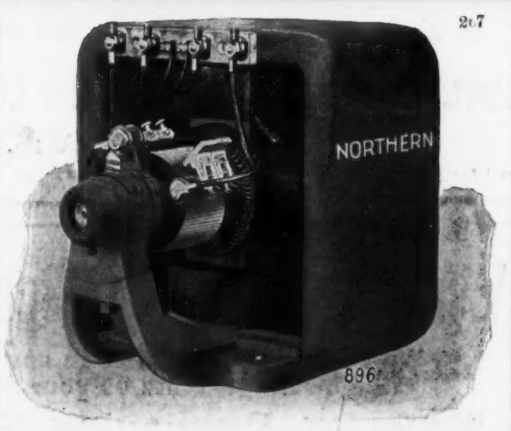
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